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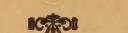

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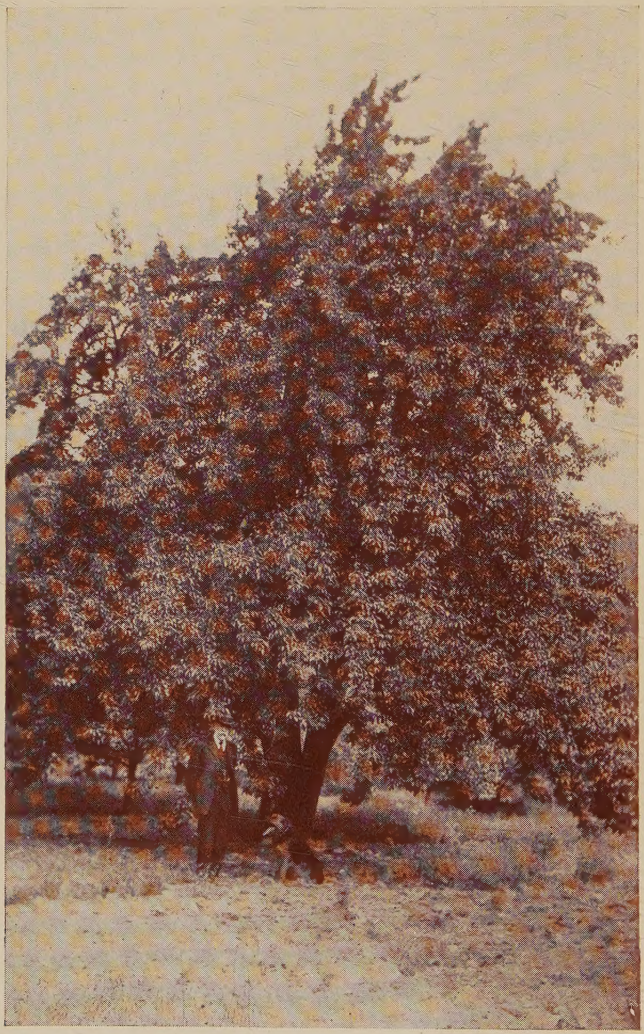

A Seventy-Year-Old Tyson Tree

The health and productivity of the Tyson variety is evidenced by this tree which when seventy years old carried thirty bushels of marketable fruit and which has never been seriously affected by blight. Because of these virtues Tyson is a good sort for the home orchard, and the plant breeder is endeavoring to combine some of its qualities in new varieties of greater commercial value

The Pear and Its Culture

Designed for Both the Amateur
and the
Commercial Grower

BY

H. B. TUKEY

Acting Chief in Research (Horticulture)
New York State Agricultural Experiment Station

ILLUSTRATED

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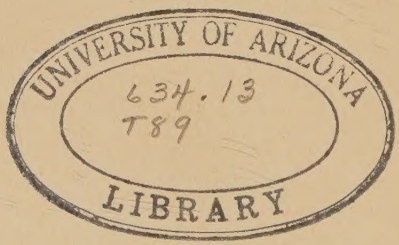

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PREFACE

THE pear is in many ways an unusual fruit. It has had a romantic past and it promises an interesting future. Certain varieties can be produced in quantity and shipped by the trainload to distant markets at the same time that the lover of growing things induces an especially difficult kind to mature a few delightful and curious specimens. It offers a great variety of shapes, flavors, textures, and sizes. It is eaten fresh out of hand, it is canned, and it is dried.

For those to whom such a fruit appeals—and there are many—this little book is written, with not so much the idea of attempting to cover the entire field in detail in so short a piece as to bring together the more important items in pear culture, to include some of the newer practices, and to indicate the trend of the industry.

The author is indebted to Dr. U. P. Hedrick, Prof. F. A. Waugh, and Dr. J. R. Magness for the use respectively of figs. 1, 8, and 10.

HAROLD B. TUKEY

Geneva, N. Y.

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CONTENTS

CHAPTER		PAGE
I.	How the Pear Developed	11
II.	Where the Pear Is Grown	19
III.	Starting the Orchard	25
IV.	Pruning, Bending, and Top-Working	32
V.	Cultivation, Fertilizers, and Cover Crops	45
VI.	The Setting of Fruit	52
VII.	Dwarf Pears	57
VIII.	Common Diseases and Insects and Their Control	65
IX.	Varieties of Pears	79
X.	Handling the Fruit	100
XI.	Future Development	113
	Index	119

ILLUSTRATIONS

A Seventy-Year-Old Tyson Tree, *Frontispiece*

FIGURE		FACING PAGE
1.	A Milestone in the History of the Pear	14
2.	Young Pear Plantings in the East and in the West	15
3.	Two Methods of Pruning	32
4.	A Cover Crop of Soybeans	33
5.	A Difference in Root Stocks	48
6.	Spreading as Practiced in the Pacific Northwest	49
7.	A Study in Blight Resistance	80
8.	A Very Successful Espalier Pear Tree	81
9.	Improving Pear Varieties by Breeding	96
10.	An Improved Type of Pressure Tester for Determining Fruit Maturity	97

The Pear and Its Culture

I

HOW THE PEAR DEVELOPED

No FRUIT, unless it be the grape, has had a more interesting and romantic past than has the pear. The reason lies largely in the fact that the pear is essentially an amateur fruit and has taken to it some of the personal touches from those who cared for it and developed it. Only recently has it become of commercial importance. The greater part of its history is identified with lovers of fruit in all walks of life from the gifted American captain of industry, Marshall P. Wilder, and the noted Belgian physician, Jean Baptiste Van Mons, down to the thrifty Dutch immigrants to America and the French and Belgian peasants in their native lands. The pear lends itself readily to amateur interest because of the strong individuality of its varieties in size, shape, flavor, and texture. In addition it responds quickly to special care and treatment. All of this has given the pear a peculiar place among horticultural plants.

America has no native pear. All varieties found in the New World have come from the Old at one time or another. These in turn trace back to a common ancestry somewhere in the general region of Central Asia. From this original form there have finally evolved two general groups of species—oriental species and occidental species, the one native to eastern and northeastern Asia, and the other native to Europe and northwestern Asia.

Of the occidental group there are only two species of importance so far as pear culture is concerned today. One, *Pyrus nivalis*, the snow pear, can be dismissed in a few words. It is a native of eastern Europe and Asia Minor, having small roundish fruit which is used extensively for perry making, "perry" being the equivalent of "cider." The name "snow pear" is said to have been derived from the fact that Austrian peasants eat the fruit when the snow is on the ground; while another name, "sage pear," has its origin in the whitish down on the under surface of the leaves giving the appearance of sage. The snow pear is unknown in America outside of special collections of horticultural plants.

The second species, however, is as important as the snow pear is unimportant. From it, *Pyrus communis*, the common pear, have come all but a very few of the 5,000 varieties that have been described in pear literature from time to time, characterized more by the deliciousness of the fruit than by any special tree char-

acters. This is the pear of history, the pear of the Greeks and the Romans, and the one commonly cultivated in the temperate regions of Europe and America. Its native home is in a region free from temperature extremes; and pure varieties of this species do best in cool, moist, rather heavy soils.

The oriental pears supply several species of growing importance, chief among which is the Sand pear, *Pyrus serotina culta*, with its cultivated varieties, Sha Lea, Gold Dust, and Daimyo. It is readily distinguished from the common pear by its broad ovate leaves, long-pointed, and sharply toothed; by flowers that appear before the leaves; and by fruits often apple-shaped, russeted, and long-stemmed, and with calyxes which drop from the fruits. It is found growing wild in Mongolia and has spread into both China and Japan, where it is cultivated. The fruit is hard, long-keeping, and of very poor quality, of little value except for preserving.

From Japan the Sand pear was taken to Europe and from there to America so that it has acquired other common names such as Chinese pear, Japanese pear, and Chinese Sand pear. Undoubtedly it has been introduced to America upon more than one occasion, one story being that it was raised from seed found in the returned trunk of an American boy who had been traveling in Asia but who never reached home.

Be that as it may the importance of the Sand pear is in the hybrids which have sprung from crosses made

between it and the common pear to give such varieties as Kieffer, Garber, and Le Conte. These hybrids have from their oriental blood a tolerance of heat, drouth, and light soils to say nothing of blight resistance so that through them pear culture has been greatly extended into southern sections of the United States. Unfortunately the poor quality of the oriental pear stamps itself strongly upon its offspring, which means that the varieties that have sprung from it are not the best.

None of the other species from the Orient are of value so far as fruit is concerned but because of the blight resistance of some they are receiving attention as stocks upon which to propagate the common pear. *Pyrus ussuriensis* and *Pyrus calleryana* are two species which have shown promise under southern Oregon conditions, *Pyrus calleryana* proving especially valuable because of its vigorous growth as well as high blight resistance.

One of the outstanding characteristics of the pear is its exacting requirements as to soil and climate. Until it found a congenial home in the cool, moist climate and clayey and chalky soils of Belgium, its improvement had been slow and desultory. Here, in an environment conducive to the production of pears of the highest quality, and under the painstaking care of the Belgians, the modern pear had its beginning.

The Greeks and the Romans knew the pear and cultivated it at least 300 years B. C. How many years

FIG. 1—A MILESTONE IN THE HISTORY OF THE PEAR

One of the many trees planted by early French settlers along the St. Lawrence River and Great Lakes Waterway down through the Mississippi River Valley

FIG. 2—YOUNG PEAR PLANTINGS IN THE EAST AND IN THE WEST

Upper—Clapp Favorite Orchard in the Hudson River Valley, New York

Lower—Bartlett Orchard in the Yakima Valley, Washington

before this it was grown by man is not known but Theophrastus, one of the early Greek writers, writing between 370 and 286 B. C. shows clearly that it was one of the cultivated fruits of the time. The Roman Pliny listed the various characters of the pear, showing plainly that much the same qualities were known then as are known today, the chief difference lying in the higher degree of development of these characters. But it was not until the later part of the eighteenth century, curiously enough at about the same time that the World was rocked with revolution, that the pear became the fancy of horticulturists and attained to anywhere near what may be called perfection. In 1805 French literature recorded but 120 varieties; by 1867 the number had leaped to 900.

Nicholas Hardenpont (1705-1774), a priest of Mons, Belgium, is credited with beginning the era of pear breeding. His success stirred his neighbors until in the forepart of the eighteenth century the origination of new pears became the chief aim of the horticultural world. Thousands of new sorts were produced by these enthusiasts led by the Belgian pharmacist, physicist, and physician, Jean Baptiste Van Mons (1765-1842), who at the height of his career had eighty thousand seedlings in his "Nursery of Fidelity" at Louvain. With the name of Van Mons stand those of Espéren, Bivort, Grégoire, Bouvier, De Jonghe, and De Nelis. Anyone who takes the trouble to examine into the records of origin of pear varieties will be im-

pressed by the numbers credited to these names. One hundred and forty-nine varieties still listed in horticultural literature owe their origin to Van Mons, 35 to Major Espéren, 46 to Grégoire, 23 to Bivort, and 17 to Bouvier.

England, not so ideally suited by climate to pear production as its neighbors across the Channel, nevertheless felt the impetus of this movement.

In America the period of European pear development was clearly reflected. Previous to 1825 most of the pears grown were of indifferent quality—seedlings brought by colonists from their European homes. Some of these trees planted by the French and English explorers and settlers of over two centuries ago were until recently in existence, marvels of size and vigor. From Nova Scotia, down the St. Lawrence to eastern Michigan, along the course followed by French missionaries and explorers and on into Illinois and Indiana, great trees stood for what has been estimated as over 200 years; while in the garden of Peter Stuyvesant, now the Bowery in New York City, a Summer Bon Chrétien tree imported from Europe and planted in its new home in 1647 lived until 1866 to bind the old in pear culture to the new.

In the vicinity of Philadelphia the Quakers were growing pears shortly prior to 1700, while the French Huguenots who came to Long Island and the lower sections of the Hudson River Valley about the same time brought with them many of the varieties they

had known in their own home. Events show clearly that wherever the French went in America the pear accompanied them.

The first records of the pear on the Pacific Coast credit the Franciscan Friars with its culture at about the time when the Thirteen American Colonies were emerging from their war for independence.

Amateur interest in pears in Europe found a ready response in America. In the quarter century following the Revolutionary War men of wealth and culture appeared who could afford the time and money to indulge an avocation. The pear thereby profited, and the development of new varieties and methods of culture in America centered about the more prosperous sections of New England, southern New York, New Jersey, and Pennsylvania.

William Coxe in New Jersey, acquainted with the leading pomologists of Europe, was the pioneer importer of the new creations. Around him was built up a strong amateur interest in New Jersey, Delaware, and eastern Pennsylvania. America's finest pear, the Seckel, had its origin in the vicinity of Philadelphia. And curiously enough the much maligned Kieffer, often rated as the poorest among pears, originated not far distant though at a later date.

In New England, William Kenrick of Newton, Massachusetts, and Robert Manning of Salem, Massachusetts, were active. To the thorough and careful work of the latter, especially, who imported most of

the sorts developed by his zealous European contemporaries, American horticulture owes much. He it was who definitely identified the Bartlett pear as identical with the English "William's Bon Chrétien"—the name by which the variety is still known in Europe.

Robert Manning, Jr., followed the example of his illustrious father, while A. J. and Charles Downing in the Hudson River Valley, Marshall P. Wilder at Boston, and Patrick Barry at Rochester, New York, are others recorded as leaders in pear culture in America. In home gardens and test orchards, activated by nothing more than interest in growing things, they weighed the faults and virtues of thousands of new sorts and laid the foundation of commercial pear growing.

Still another step in pear development was the advent of the Oriental, Chinese, or Sand pear some time before 1840. Now began the hybridization of this species with the common pear, resulting in the Le Conte in 1846, the Kieffer in 1873, and the Garber about 1880. Dozens of hybrids have since been produced, which because they derive from their Oriental parent a tolerance of hot, drouthy conditions and light soil, together with a fair degree of resistance to pear blight, have proven boons to middle-western and southern pear growing sections.

II

WHERE THE PEAR IS GROWN

In its European home the pear is possibly the most popular tree fruit, while in this country it is of major importance in but few sections and is cultivated not much more than the cherry and plum. This difference is due to a number of factors, chief among which is the fact that the climate of Europe, in which the pear reaches its greatest state of perfection, is more equable than that of America. Shortage or excess of moisture, extreme heat, extreme cold are all detrimental to the pear.

The regions in North America where commercial pear growing has reached importance are those tempered by adjacent bodies of water and favored by uniform moisture supply. With the advent of hybrid pears, pear growing has been greatly extended, but pears of the European stock are still grown only in favored localities. In the southern states summer temperatures are too high; in the central West extremes of heat and cold together with summer drouth are unfavorable; in the northwestern plain states severe cold is the limiting factor; leaving only the Pacific

Coast states and the northern tier of eastern states at all suited to pear production.

California and New York are the two states of most importance. For years New York has been the leading pear-producing State in the Union. Within the past decade, however, California has overtaken her, and the present indications are that she will be further outdistanced. In number of bearing trees New York was slightly in the lead at the time of the 14th United States Census but a glance at the future indicates that this supremacy will be short lived, if indeed it has not already passed.

	New York	California
Trees of bearing age	2,788,761	2,305,646
Trees not of bearing age	967,573	2,178,526
Total	3,756,334	4,484,172

These two rival states are the champions of the two great regions into which pear growing may be divided. New York, representing eastern pear culture, has contented itself for the most part with what nature offered, confining production by processes of trial, failure, and success to those sections which by soil, rainfall, and general climatic conditions seemed best suited to the pear. Pear blight, frost, winter cold, drouth, and other misfortunes have been balanced against proximity to a large consuming market.

California, on the other hand, representing western

pear culture, has endeavored to control conditions so far as possible. Irrigation, frost protection, and blight control are three typical examples of this effort, which help to balance high production of a quality product against the long haul to eastern markets. So far the balance sheet is in favor of western growers though the stimulus to increased plantings in those sections bids fair to present an accute marketing problem at some time in the future. The East for its part, though it has hardly been holding its ground in the fight against pear blight and pear psylla, is experiencing a new interest in pears wherever natural conditions favor their production.

The eastern section may be divided roughly as follows:

1. New England. Production is scattering and is no longer of importance excepting as it provides for home and local market consumption. Varieties are Bartlett, Clapp Favorite, and Seckel, together with some Kieffer.

2. New York. Pear psylla and pear blight have seriously reduced production. In western New York plantings are more than 50 per cent. Bartlett, followed by Kieffer, Seckel, and Clapp Favorite. The leading counties are Niagara, Orleans, Monroe, and Wayne. In the Hudson River Valley, Bartlett constitutes about one-third of the crop; Kieffer, Seckel, Clapp Favorite, Beurré Bosc, and Duchess d'Angoulême making up

the balance. The crop is grown for the most part in the counties of Columbia, Ulster, and Greene.

3. New Jersey and Delaware. The leading variety in this section is Kieffer, which is about three-fourths of the total. The remainder is divided between Bartlett, Le Conte, Seckel, and Duchess d'Angoulême. Burlington, Cumberland, and Camden Counties produce the bulk of the New Jersey crop.

4. Michigan. Kieffer constitutes about half the crop, followed by Bartlett, Beurré d'Anjou, Clapp Favorite, Seckel, and Duchess d'Angoulême. Production is confined chiefly to the eastern shore of Lake Michigan in Berrien, Van Buren, and Alleghany Counties.

5. Illinois and Missouri. Plantings in this section are in Marion, Union, and Pulaski Counties in Illinois, and Pike and Daviess Counties in Missouri. Kieffer is grown almost exclusively.

The western section may in turn be divided as follows:

1. Washington. The Yakima Valley is the principal pear section though plantings are spreading into other localities. The main variety is Bartlett, with some Beurré d'Anjou, Easter Beurré and Beurré Bosc.

2. Oregon. Both the Hood River Valley in the north and the Rogue River Valley to the south are increasing their production. The Rogue River Valley is the largest section in the State. Varieties are Bartlett, Beurré d'Anjou, and Beurré Bosc.

3. Colorado and Utah. The Grand Valley in west-

ern Colorado and the Provo District in Utah produce pears to a limited extent. Varieties are Bartlett, Beurré d'Anjou, Beurré Bosc, and Easter Beurré.

4. California. Plantings have been extensive in California within the last decade, with Bartlett as the leading variety, followed by Beurré d'Anjou, Beurré Bosc, Easter Beurré, Howell, and Winter Nelis. Only about one-half of the crop finds its way to fresh fruit markets, the other half being canned and dried. The largest acreages are in Sacramento County, the Santa Clara Valley, and Placer, Solano, and Sonoma Counties.

Aside from the general regional characteristics that define pear production, there are certain factors within these regions that determine location. It has been indicated that a moderated climate with uniform moisture supply is essential. In New York State, for example, pear growing has developed almost entirely in sections that provide these conditions. Monroe County in western New York, where climate is tempered by both Lake Erie and Lake Ontario, has over 600,000 trees, and three counties along the southern shore of Lake Ontario, Orleans, Monroe, and Wayne, have over 300,000 trees each. In the Hudson River Valley two counties, Columbia and Ulster, lead all others, with over 300,000 trees each. Sixty per cent. of all the pear trees of the State are in these 6 of the 62 counties.

A contributing factor is soil. Experience has shown

that heavy soils are preferred by pears, the reason probably lying in the fact that clayey and silty soils are more retentive of moisture and so provide more equable conditions than do lighter soils. A typical example of this situation is to be found in the Hudson River Valley, where pears have been grown for 200 years. In the course of this period pear orchards have gradually settled to the low lands, which in this case means heavy soils, while other fruits have taken to the upland hills and lighter soils. Likewise in central Illinois a heavy type of soil in the vicinity of Alma and Marion finds a pear industry established there.

III

STARTING THE ORCHARD

Location and Soil—Soil for the pear must be fertile but not too rich. Rich land tends to produce a green, vigorous growth which is susceptible to pear blight; yet most pear trees are slow growing and not overly strong so that the soil must not be low in fertility. In practice too rich land is seldom met with. Since it is naturally a deep-rooted tree, the pear requires a deeper soil than its relative, the apple. Unless it is in congenial surroundings, the tree does not do well, and the fruit is astringent, sour, gritty, or otherwise inferior. One of the reasons Bartlett, Seckel, and Clapp Favorite are more popular than other varieties is that they do well under a wider range of conditions. For most varieties of pears the problem is to find the environment in which each is happiest. It is true that pears generally grow best on a heavy soil, but they may do well on other soils provided other conditions are right. Heavy soils are more retentive of moisture than light ones and since the pear is exceedingly insistent upon an even moisture supply, clay soils may be expected to be especially suitable. Hybrid pears,

which withstand heat and drouth much better than varieties of the pure European species, often grow well on sandy or gravelly soils. Wet soils are to be shunned for all pears.

Elevation and exposure are of small importance in pear production, the other factors involved greatly outweighing them. All other things being equal, however, good elevation and a western exposure are to be preferred. Frost pockets which do not permit of good air drainage are, of course, to be avoided.

Securing the Trees—With no other fruit is good stock more necessary than with the pear. Trees in the nursery are very susceptible to blackheart, a form of winter injury, identified by dark discoloration of the wood. Trees with this trouble should be discarded as they never make good orchard plants. Stock with crowngall, or hail or insect injury, or stock that is dry or shrivelled is not desirable, nor are trees with large, soft, green tops. Well-ripened, two-year-old trees of short, stocky growth are to be preferred. The particular locality in which they are grown is of no importance so long as these precautions are observed.

The pear is usually propagated on seedlings imported from Europe, though it may be grafted on the quince as a dwarfing stock. The planting of dwarf trees in commercial orchards, however, has been discontinued in America, because the trees are difficult to grow in the nursery and demand too close attention in the orchard, and because they often strike root above

the stock and become standards. Yet for the amateur, they are worthy consideration, especially since some varieties do better on the quince than on pear roots. The subject will be discussed in detail in Chapter VII.

No stock in use at the present time is thoroughly satisfactory. The common European stock is the most successful but it suckers and is subject to blight attack, thus permitting the disease to enter the roots unsuspected only to cause death to the tree. It was hoped that the vigorous hybrid pears would furnish a good stock but the results have been disappointing. In the case of Kieffer, however, there is practical evidence that trees propagated from cuttings, in which case the trees would be growing on their own roots, are much superior in vigor, health, production, and length of life to those budded on French stock.

Lately attention has been given to some of the oriental species as vigorous blight resistant stocks. *Pyrus calleryana* and *Pyrus ussuriensis* have both proven blight resistant in Oregon, the former being the more promising as a stock because of the fact that it is more vigorous than *P. ussuriensis* and produces a better tree. There is no information available as yet concerning the use of either of these stocks in eastern sections but they will undoubtedly receive thorough trial.

Planting the Trees—In northern sections, spring planting is always to be preferred to fall planting,

though in sections where winters are not severe fall planting is entirely satisfactory. The distance apart to plant varies with the variety and the methods of cultivation and pruning. Ordinarily, pears are set 18 x 18 feet, or 20 x 20 feet; but in the case of such strong-growing varieties as Kieffer, Beurré d'Anjou, and Flemish Beauty they may well be set at a distance of 22 or even 25 feet.

Broken roots should be trimmed before the trees are set, otherwise the less the root system is interfered with the better. The ground should be well prepared and the tree set slightly deeper than it stood in the nursery. Fertilizers in the tree holes in contact with the roots are to be avoided. One of the most common sources of failure is in not getting the soil packed firmly about the roots. It is not enough to firm the soil about the sides and tops of the roots; it must be packed *under* the roots as well. Too often an air pocket is left immediately beneath the crown, a constant menace to the life of the tree. With the soil firmly in place, a mulch of lose dirt on top to prevent evaporation completes the job.

Pruning the Trees—Since the root system has been greatly reduced it cannot be expected to furnish the unreduced top with all the moisture and food material that it needs. Accordingly the top should be reduced in turn, a matter which very largely takes care of itself in the pruning necessary to proper heading and training. If the trees are fall planted, prun-

ing had better be left until spring because of possible winter injury at the tips of the branches.

Pear trees are headed lower than apple trees, as they are especially subject to sunscald and are also upright in habit of growth. Twenty-four to thirty inches is a safe height at which to start the scaffold branches, all shoots below this being removed. With the more spreading Beurré d'Anjou, the head ought not to be so low as for the upright Bartlett or Clapp Favorite.

Once the three, four or five branches are selected for the framework of the tree, as little cutting back should be done as possible. Too much pruning induces a rank, succulent growth susceptible to fire-blight. Moreover, too great a reduction of leaf area is as bad, if not worse, than too little, for while severely pruned trees may appear to be making vigorous new growth they will usually be found merely replacing what has been removed by pruning. Frequently it will be possible to leave the scaffold branches untouched, and whenever this can be done the tree will benefit. The rule should be to do as little pruning as possible, aiming to thin out undesired branches entirely rather than heading back those that are left.

There are two general forms to which the tree may be trained, namely vase-shaped and central-leader. In the case of the former no central leader is permitted to form so that a tree is produced which is v-shaped or vase-shaped, as the name implies. The central-leader type is the natural habit of the tree, one shoot

ascending and the scaffold branches coming off from it at various points along its length. When the tree has reached the desired height the central leader is not permitted to go further.

The vase-shaped tree has much in its favor. It is open, permitting light to enter and air to circulate; it is lower, providing easier picking; and if blight is severe less damage is done by attack upon one of its scaffold limbs than upon the central leader. This system is almost universal in the pear regions of the far West.

On the other hand, the close-centered tree seems better adapted to eastern conditions. It is more easily managed, requiring less detailed attention. It carries more fruit because trees may grow larger and because they come into bearing earlier as a result of less pruning. In addition sunscald and crotch injury are serious problems in the colder section of eastern America and exact severe toll from open, vase-shaped trees. In the main, the natural close-centered tree will be found the better.

Care the First Season—It is a question whether fertilizers should be applied to trees the first year they are set. There is reason to believe that considerable injury is done to young trees by overzealous fertilizer applications. If the orchard is on good soil—and it should be—all the plant food necessary will be available for the first season's growth. In addition there is the possibility of forcing too succulent a growth which

may both blight readily and fail to ripen sufficiently to pass the winter without injury. If fertilizers are used they should be used sparingly and kept well back from the trees.

Cultivation should be frequent and thorough so as to keep a mulch of loose dirt on the surface of the land. Sod mulches and permanent leguminous sods have no place in the young orchard though they may serve to advantage in mature orchards under certain conditions. If the entire area cannot be kept well cultivated, the space close to the trees should be. A one horse cultivator working on each side of the trees may sometimes be used to advantage when press of work makes more thorough cultivation impossible. A cover crop sown the middle of July is desirable.

Neglect in the young orchard is serious. Most successful orchards date their success to painstaking care the first few years of their lives.

IV

PRUNING, BENDING, TOP-WORKING

Pruning in General—The old accepted principles of pear pruning involved all the intricacies of detailed cutting and pinching, summer pruning, and root pruning. The new methods have swung to the opposite end of the scale to the point where little or no pruning is recommended. The change seems reactionary at first glance but it is logical enough when examined more closely.

Because of the amateur interest in pears a century or more ago, trees received special individual attention, and since the pear responds readily to such treatment this came to be the accepted method of training. It involved watching each tree as an individual, to be petted and preened and cut and pinched as the operator or the thought of the time dictated. By its use delicate varieties were made to fruit, late-bearing sorts were made to bear younger, small pears were made large and large pears still larger, fine texture and quality were secured, and the methods quite justified themselves. With the advent of commercial pear culture and extensive plantings it was no longer possible

FIG. 3—TWO METHODS OF PRUNING

Upper—Low-headed and little-pruned

Lower—High-headed and stubbed regularly

FIG. 4—A COVER CROP OF SOYBEANS

to give such detailed attention, but since the methods in use involved more or less cutting trees were cut rather severely without any great consideration of the fine points which the art of pruning had developed.

Now pruning by itself is essentially a dwarfing process. Leaves are the laboratories in which by the aid of sunlight, food materials are manufactured into food for growth and fruit production. When leaves and buds are removed either by dormant pruning or summer pinching and cutting, the manufacturing powers of the tree are reduced and the tree is dwarfed. Before a tree can fruit it must build up a store of food in the form of sugars and starch in its twigs and branches, and obviously since these materials are manufactured in the leaves anything that reduces the foliage of the tree delays its bearing. It is this school of thought backed by observation and experiment which has advocated the "little pruning" now in vogue. And with the emphasis now being placed upon commercial production, reduced costs, and the like this type of pruning has met with ready response. Large blocks of trees are now expected to bear large uniform crops as early as possible so as to reduce the years of blight hazzard before a crop has been borne and so as to bring an early return upon the investment. The system of pruning has changed, then, largely because the methods of growing have changed.

The pear bears its fruit largely upon spurs on wood two years old or older. These spurs may bear re-

peatedly for a number of years, giving rise to the long branching type of spur so characteristic of the pear. The aim in pruning is to keep these spurs vigorous and growing and to encourage the formation of new spurs to take the places of old or broken ones or to give greater bearing area as the tree grows larger. The flowers appear in clusters of five or six, the outer flowers in the inflorescence blooming before the central one which is just the reverse of the way an apple flower cluster develops. The fruit is usually borne singly.

One other characteristic of pear trees is important in this place, namely the flexible, willowy nature of its wood. Limbs will bend far before they will break and the strain upon the crotches is much less than in the case of the apple. The interest in bending shoots as a form of training is an outgrowth of these qualities.

The technic of pruning is no different with the pear than with other orchard plants. The work is best done after the most severe part of the winter is over because of the drying out and dying back at the tips that sometimes occurs. Pear wood, it must be remembered, is more tender than apple wood.

There are three distinct types of cuts made in pruning. One is that in which a branch or shoot is partly cut off, best described as "heading-back." The second is that in which a branch or shoot is removed down to its point of union with another growth, often spoken of as "thinning-back." The third is known

as "thinning-out," which is the removal of a shoot or branch entire back to the older wood from which it originally grew. "Heading-back" is the method of pruning Kieffer trees in some sections where half or two-thirds of the preceding season's growth is clipped back every year or every other year. "Thinning-back" is the type of pruning used to lower the height of a tree, a cut being made at a point on a strong upright branch where a strong outside lateral shoot occurs. "Thinning-out" describes the cutting out of suckers, cross limbs, and undesired lateral shoots.

Heading-back is no longer so universally practiced as at one time, thinning-out and thinning-back having met with greater favor in part because less sucker growth is induced. Heading-back encourages strong shoot growth from buds at the point where the cut is made, whereas following thinning-out and thinning-back growth exerts itself in renewed vigor upon the branches from which the wood was removed with little attendant sucker growth. While the distinctions may seem a bit fine drawn they are worthy of complete understanding, as a little practice and observation will show.

In heading-back, the cut should be made to an outside bud and about a quarter of an inch above it. This is far enough away to prevent the bud drying out and yet close enough so that no awkward stub will be left. With either thinning-back or thinning-out the cuts should be made as close as possible to the

branches to which they are cut back so that the wounds may heal more quickly. For small wounds no protective covering is needed. For large ones the use of coal tar paint over the center of the wound without covering the growing cambium layer at the edges is good practice.

Pruning the Young Tree—From the time the trees are set until they come into bearing the object should be to train them, with as little cutting as possible, to one or the other of the two general types of trees discussed in connection with starting the orchard, namely the open, vase-shaped type and the natural close-pruned or central-leader type. Some cutting must of necessity be done, as for example the removal of interfering branches, but let it be no more than is necessary.

In some Kieffer growing sections it is the practice to head-back Kieffer trees each season from the time they are set, removing half to two-thirds of the preceding season's growth at each pruning. The thought is to produce a stocky growth, and probably that much is accomplished though it can also be accomplished by other means. At the same time, however, the trees are dwarfed and delayed in their time of coming into bearing. When little-pruned trees bear their first crop the branches, which until then appear overly tall and upright, bend with their load and present an open heavy-bearing tree. The natural bending together with the fruiting tends to check growth and cause the

branches to thicken. Recent experience indicates that little or no pruning results in two to four years earlier fruiting and much larger trees. Kieffer is perhaps the most vigorous growing of all pear varieties yet the principle of little pruning while young apparently holds even to it. When trees become older or overload with fruit the problem must be handled differently as will be discussed a little further along.

There is still another argument in favor of little pruning which applies especially to pears. It is contained in the expression "Pruning causes blight," and there are any number of successful eastern pear growers who never allow a knife in their pear orchards until after they have begun fruiting. The answer probably lies in the fact that heading-back induces strong shoot growth near the points of cutting and soft succulent growths are very susceptible to blight. This point is of much more importance in the case of Clapp Favorite, Howell, Bartlett, and other varieties that blight easily than in the case of Kieffer and Seckel, which are relatively resistant. Thinning-out, however, can be resorted to with little danger of inducing such growth.

Bending—In the Pacific Coast States, especially California, a system of tying and spreading the branches has been developed which has induced early fruiting with a minimum of pruning and which may hold suggestions for eastern growers. It has been most successful where unusually vigorous growing con-

ditions would otherwise require heading-back and thinning-back in order to keep the trees in hand. Tying shoots down has made broader trees, checked growth, and caused early fruiting, which is in itself a dwarfing process, the combination of the three resulting in high production early in the life of the tree. By this method full advantage has been taken of the vigorous growing conditions and yet no severe pruning has been necessary. Thinning-out has been sufficient.

Of course bending is not a new procedure in horticulture. Its value in commercial pear culture has not been determined and the principles which govern are little understood. The response of a branch to bending, however, is closely identified with polarity, which is the principle that shoots tend to grow upward from the normal upper end of a shoot and that roots tend to develop at the lower end. There have been several theories advanced for this phenomenon but none is established. To go one step further, the top bud of a shoot is the point of greatest vigor and tends to take the lead from those beneath it. Once it has the lead it maintains it. The theory has been advanced that the shoot which has the ascendency over the others develops an inhibiting substance which passes down the shoot and inhibits the development of the others. If, then, a branch is bent down so that the end bud is lower than others on the shoot it can be readily appreciated that other buds may tend to take the lead

and that the full energy of growth may be developed along the branch in an entirely different way than normal yet without any reduction of leaf surface through pruning. This is the theory upon which the manipulation depends.

It will be seen at once that the degree of bending employed determines the nature of the response. Spreading an upright branch outward is obviously quite different than placing it horizontal, and both are quite different than bending it low. In practical application the value of bending the branches down has so far been observed only under very vigorous growing conditions as already discussed.

Spreading, however, is better understood. Spreading occurs naturally when a full crop of fruit is borne, and as a result light may be let in, leaves may be able to elaborate more food, and the points of vigor on the branches may be altered. The benefit from this natural fruiting and spreading is a familiar occurrence in the Northern Spy apple and the Kieffer pear.

Growers of pears in the Pacific Northwest have shown clearly that under their conditions artificial spreading is profitable. The plan in use is to keep upright branches "off center" by tying to one side by means of a string and a peg in the ground, by pulling down with a suspended weight, and by forcing to one side with cross braces placed against other branches or other trees. It is claimed that when branches are kept off center in this way that they will fruit heavily

and pull themselves over naturally. Furring strips of various lengths are commonly used as cross braces, while binder twine is used for tying.

It seems likely that under eastern growing conditions the Kieffer might respond to such treatment. How other varieties might react it is impossible to say. It must be pointed out clearly that growing conditions on the Pacific Coast are quite different from those on the Atlantic Seaboard. A fair comparison may be found in the fact that on the Pacific Coast, Bartlett trees are in some localities headed-back half to two-thirds the previous season's growth. Such a practice could not be followed in the East because the Bartlett tree does not have sufficient vigor under eastern growing conditions. On the other hand the vigorous Kieffer variety is usually stubbed back in eastern orchards. The comparison may be made in a general way, then, that the Bartlett tree grows in the West with much the same vigor that the Kieffer pear does in the East. Accordingly it is unsafe to make direct application of practices in other sections, though it is always worthwhile trying new suggestions in a small way.

Pruning the Bearing Tree—Bearing trees in their prime need very little pruning. Cross branches and dead limbs should be removed, and thick trees should be thinned out, as much to help in insect and disease control as any benefit that may be derived in growth.

With the Kieffer, however, a different course must

be pursued. Bearing trees are likely to overload and to produce undersized fruit. The customary practice which really amounts to a thinning operation, is to head-back the preceding season's growth about two-thirds each year, commonly termed "stubbing." Some growers prefer to cut back into two-year-old wood every other year. Both practices are successful.

On the Pacific Coast all pear trees are headed-back severely each year though more recently a system of so-called long pruning has been practiced in which lateral shoots are thinned-out and less heading-back is done. It is claimed that the long system of pruning gives more fruit in many cases.

Pruning the Old Tree—A tree past its prime must be restored to new vigor if it is to be kept bearing profitable crops. Old trees frequently bloom profusely but set little fruit, though the problem is not one of pollination. The trouble is usually lack of sufficient vigor to carry the fruit.

One method of renewal is to cut off half the old spurs so that the energy of the tree may go into the remaining ones. Another procedure is to thin-back severely to outside lateral branches so as to build an entire new fruiting top. Such a plan works very well if half the tree is treated in this way at a time. Cutting too severely any one year is always at the risk of blight infection in the resulting new vigorous wood.

Training to Particular Forms—Training to geometrical figures and particular forms has no place in

quantity production. It is suited only to those who enjoy shaping plants to suit their fancies and who can provide the time and attention that the work demands. Some of the simpler forms, however, can be produced with small effort. In Europe these practices are the usual thing while in America they are the unusual. In Europe plants are trained as ornaments against walls and buildings, on trellises, and by themselves, producing some very attractive and interesting forms. Aside from the fact that it is the customary thing to do, training against walls with southern exposure offers the possibility of maturing long-season fruits in a cool growing season, such as England provides. Furthermore expert gardeners are able to produce fruits of exceptional size and quality.

European nurseries offer trees for sale in a variety of forms and the purchaser selects the type that best suits his purposes. Since American nurseries do not provide these forms it is necessary to purchase small yearling trees which have buds low on their trunks. Then by staking or tying to a support or trellis, or by pruning, twisting, and pinching they may be trained in almost any conceivable shape. And because pear wood bends easily and because pear trees respond readily to such treatment they are frequently used. A more detailed discussion of methods will be found in Chapter VII, which treats of dwarf pears.

Top-working—The pear is as easily top-worked as the apple either by budding or grafting. Budding,

which is best adapted to young trees, is done in midsummer at a time when the bark slips and when the bud-wood is mature. The first of August is the usual time in New York State. Buds are taken from vigorous growths of the current season, making the cuts so as to take thin shields of bark and wood along with the buds. Leaves are, of course, removed. Into a T-shaped incision in the bark of the branch to be top-worked the bud is slipped. It is then tied securely in place with raffia or string. Within three or four weeks, when the buds have set, the strings should be cut so that the growth of the branch will not restrict the movement of sap to the buds. The next season before growth starts the branches must be cut off just above the buds, which then push out vigorously.

The whip graft is also suited to young trees, being especially useful with branches about the diameter of the finger. The operation is done during the dormant season, preferably just before growth starts in the spring, using vigorous one-year-old wood for the cion. Four inches is a good length for the cion. A slanting cut a little over an inch in length is made across both the cion and the stock which are then split about an inch lengthwise in the middle of the cut surfaces and the tongue of the cion slipped into the corresponding cut on the stock. The cambium layers next to the bark should be matched and the whole firmly tied and waxed.

For older trees the cleft-graft is used. The branches

are cut off at the desired point during the dormant season and split lengthwise. Two cions about six inches long are tapered wedge-shaped at one end and slipped into each side of the cleft so that the bark of both stock and cions match. Usually the pinching of the stock is sufficient to hold the cions firmly in place. If it is not, they must be tied. Stub and all should be thoroughly covered with grafting wax and the job is done.

Not all varieties of pears can be top-worked upon other varieties. In the main, all varieties belonging to the common European species such as Bartlett, Clapp Favorite, Seckel, and Beurré Bosc can be worked upon each other. Likewise the oriental pears, Le Conte, Kieffer, and Garber can be worked upon each other. But when varieties of one group are tried on those of the other, trouble follows.

Top-working Kieffer trees to better quality varieties is unsuccessful unless the work is done when the trees are less than five years of age. There are exceptions to the rule and the subject is usually discussed with violent pros and cons. Experience shows that the top-working of bearing Kieffers is not successful, and that most so-called successful cases are either short-lived successes or else the work has been done when the trees were young.

V

CULTIVATION, FERTILIZERS, AND COVER CROPS

Some orchard plants will tolerate neglect. The pear will not. Pear trees are none too certain of life, and anything that helps to conserve moisture and increase the supply of available plant food materials—yet not oversupply them—should be carefully observed. Clean cultivation early in the season followed by a good cover crop sown the middle of July is to be strongly recommended. There are peculiar conditions which call for modification but the vast majority of orchards will find this practice best.

Cultivation—Cultivation should begin with plowing as early in the spring as possible. Since many orchards are on heavy soil it will often be difficult to plow as early as desirable, but if it is at all possible the land should be worked by blossom time. The reason is that trees make their growth early in the season and any practice that is to favor growth should come previous to that time.

In some pear sections on heavy clay soils with moderate winters plowing is done twice a year—to-

wards the trees in the fall and away in the spring. It is difficult to ascertain the origin of the system but most growers agree that it is done so as to afford better drainage as well as some protection at the crowns of the trees. Results justify the methods, yet in most sections one plowing a year is sufficient, while on light soils disking alone may suffice.

Spring plowing is to be preferred to fall plowing, mainly because of possible injury to roots by winter cold. In sections where winters are not severe, this point is of little concern, but it is more often an important item in successful pear culture than is usually thought. With the cover crop turned under in the fall and nothing left to hold the snow, the ground is often left bare and injury is done the roots. The other side of the argument is that heavy soils can often be worked to better advantage in the fall than in the spring. If history has shown that winters are not serious, then fall plowing is to be preferred; otherwise the orchard had best be left until spring. Deep plowing is always to be discouraged, especially close to the tree, for while the pear is a relatively deep-rooted plant its roots are often seriously injured.

The orchard should be kept free from weeds by harrowing. The disk harrow is the favorite tool, though on stony soil the spring tooth harrow is much better. The spike tooth harrow is useful on level land in maintaining a dust mulch. Thorough tillage so as to keep the orchard free from weeds and so as to keep a cover-

ing of loose dirt to check evaporation is a proven practice. Cultivation should stop by the middle of July or the first of August so that the wood may ripen before winter.

Much has been said recently in favor of the sod mulch system in the orchard, and there is abundant evidence to show that it is often successful with other orchard plants. With the pear, however, the danger of fire-blight enters to complicate matters. More often than not the pear orchard in sod has been left in that condition in order to check a vigorous growth that was blighting severely. Orchards on heavy land will often seem to do well under such conditions while they are young, but they will not thrive long.

Of course there are all degrees of sod mulch. The worst kind and the one that should not be permitted is that in which the grass crop is cut and harvested. If it is cut and allowed to lie or is spread around the trees the system may prove advantageous on rough or stony land or on land which is unusually well supplied with moisture. The legume sod, such as permanent alfalfa or sweet clover, has not been sufficiently tested to determine its worth. It is known, however, that apple orchards with legume sod have sometimes become too vigorous, because of the accumulation of nitrogen. With the pear too great vigor might be fatal because of the opportunity for blight.

Cover Crops—A good cover crop fits nicely into a system of clean cultivation. Continued tillage will

soon exhaust the soil of humus and organic matter. Heavy soils low in organic matter are difficult to work. They puddle easily, fail to hold moisture, and crack and "lump up" under cultivation.

Organic matter besides improving the physical nature of the soil increases its fertility. Soil bacteria live upon material of this kind, and more and more it is being realized that they play a large part in keeping up soil fertility. Furthermore organic matter in its decomposition helps to liberate food materials in the soil and make them available to the plant. A crop to be turned under for green manure purposes is therefore very desirable.

Winter protection to the roots has already been mentioned in the discussion of fall plowing. A crop which stands erect and holds snow is good insurance against winter injury. Again, the ripening of the wood in the fall is hastened by a crop growing in late summer, while shading of the soil during the heat of summer and prevention of washing are other important benefits. The cover crop, using the term here in its broadest sense, aims to take care of these problems.

There are two kinds of crops used as cover crops. (1) Leguminous crops such as alfalfa and the clovers, and (2) non-leguminous crops such as buckwheat, millet, and rye.

Seeds of legumes are relatively expensive and aside from soy-beans and vetch leguminous crops have yet to demonstrate their usefulness in the pear orchard.

FIG. 5—A DIFFERENCE IN ROOT STOCKS

Upper—An adjacent unprofitable planting growing on French roots
Lower—An adjacent profitable Kieffer orchard growing on its own roots in a sandy soil

FIG. 6—SPEEDING AS PRACTICED IN THE PACIFIC NORTHWEST

On the other hand non-leguminous seeds are among the less expensive and some of the crops have established their worth through trial.

Buckwheat, oats, rye, wheat, and millet, all make good cover crops. A combination of buckwheat and millet, three or four parts of the former to one of the latter by volume, is not expensive, is reliable, kills with frost, stands erect, and produces a bulk of organic matter. Rye and wheat are best when sown in September and not plowed under until spring. If rye is too strong growing, wheat makes a good substitute. For the shaded orchard vetch, though expensive, is among the best.

It should be the plan to fill the soil with organic matter while the orchard is young before shading becomes a factor. Evidence is beginning to accumulate to the effect that the most profitable orchards in later life are those which have had close attention while young.

Common seedage rates per acre are as follows:

Barley	2	bushels
Buckwheat	1½	bushels
Buckwheat	1	bushel
Millet	1	peck
Millet	1	bushel
Oats	2-3	bushels
Rye	1½	bushels
Soybeans	1	bushel
Rye	½	bushel
Vetch	3	pecks

Sowing should be done about the first or middle of July whenever there is sufficient moisture for germination.

Fertilizers—Fertilizers have not played a large part in pear production mostly because of the ever-present danger of fire-blight whenever too vigorous growth is stimulated. In addition chemical analysis shows that pear trees do not remove as much food material from the soil as apple trees and therefore probably require less. If, however, trees show lack of vigor, yellowish foliage, short growth, and failure to set fruit, fertilizers should be tried. Common applications figured on the acre basis in essential elements are as follows:

Nitrogen	50 pounds
Phosphoric acid	50 pounds
Potash	100 pounds

Applications for smaller areas may be computed. There are 43,560 square feet in an acre. Fertilizer companies are required to give the analysis of their products.

Nitrogen is the only one of the three important elements of plant food which may be expected to produce a response. The other two, phosphorus and potassium, appear to be of value only as they affect the growth of the cover crop and thereby add organic matter to the soil.

Nitrogen may be supplied in such forms as manure,

sodium nitrate, ammonium sulfate, dried blood, and tankage. It should be used with extreme caution, starting with small amounts and increasing as no harmful effect is observed. A safe trial application for a 15-year-old tree is 3 to 4 pounds of nitrate of soda or 2½ to 3 pounds of ammonium sulfate, spread in a circle about the tree near the ends of the branches. Spring applications, about two weeks before bloom, are recommended though there is some indication that early fall application, about the 1st of October, may be of value in soils which do not warm up rapidly enough in the spring to make available sufficient plant food material.

Phosphorus is carried in acid phosphate, raw rock phosphate, bone meal, and basic-slag. Acid phosphate, which is the most common form, is applied at the rate of 250-300 pounds to the acre. Often phosphorus though producing no response when applied alone does so when applied in combination with nitrogen.

Potassium is found in potassium chloride, potassium sulphate, kainite, and wood ashes. Potassium chloride at the rate of 100-150 pounds to the acre is a normal application.

VI

THE SETTING OF FRUIT

FAILURE to set fruit even though the tree blooms profusely is one of the common faults of the pear, especially with the Beurré d'Anjou and Seckel varieties. Two factors are involved, namely pollination and nutrition.

Pollination—The chief function of a pear tree is to reproduce itself. This it does by seeds, which are developed from the flowers and carried in the fruit. There are two essential parts to a flower, the male part, producing the yellow pollen-powder familiar to anyone who has buried his nose too deeply in a fragrant blossom, and the female part or pistil which when fertilized produces the seed. Pollination consists in the placing of pollen on the end of the pistil, the pollen grain then germinating and growing down the pistil and fertilizing the blossom. Without fertilization no seed will be formed and fruit will seldom be set.

Bees perform most of the pollination in their quest for food from the blossoms. Cold weather, rainy weather, or anything that interferes with their work

influences the set of fruit. In addition rain may wash the pollen from the pistils, frost may injure the parts, or a freeze may kill the entire bloom.

Not only must a blossom be pollinated before it will set fruit, but it must also be pollinated with the right kind of pollen. For all practical purposes it may be said that a variety cannot be fertilized with its own pollen. That is, a Bartlett tree, for example, will not ordinarily bear fruit when pollinated with its own pollen. This condition is called "self-sterility" and the variety is said to be self-sterile. Bartlett, Beurré d'Anjou, Clapp Favorite, Lawrence, Winter Nelis are all reported mostly or completely self-sterile, while Seckel and Kieffer are often in the same class. It is because of these facts that pollination is of especial concern to pear growers—not because there is more sterility among pears than other fruits but because the varieties most grown are commonly self-sterile.

A variety may be self-fertile in one locality and self-sterile or partially so in others. In fact there are solid Bartlett orchards on record apparently self-fertile though the fruits have few seeds and are small. That is to say, climate, soil, insects, weather at blossoming time, and general health and vigor of the tree plays a large part in self-sterility. The bulk of the evidence makes it plain, however, that practically all pear varieties are sterile to their own pollen. Pollen from some other variety is necessary before a tree will bear to capacity. And even when a variety is held to be self-

fruitful, cross pollination will usually increase the yield.

There are no cases on record of inter-sterility in the pear, that is where one variety will not fertilize another, but some varieties are better pollenizers than others. Winter Nelis, for example, is considered an especially good pollenizer as are also Easter Beurré, Clapp Favorite, and Beurré Bosc. In the pear growing sections of the Pacific Northwest Easter Beurré is being planted for the purpose of pollinating Beurré d'Anjou. Seckel, on the other hand, has proven a poor pollenizer for Bartlett.

Kieffer will fertilize Bartlett and Bartlett will fertilize Kieffer. Beurré d'Anjou, Beurré Clairgeau, Doyenné du Comice, Dana Hovey, Easter Beurré, Howell, Winter Nelis, Lawrence, and Duchess d'Angoulême have been determined satisfactory for planting with Bartlett while Le Conte, Garber, Lawrence, Duchess d'Angoulême, Beurré d'Anjou, and Beurré Clairgeau have proven satisfactory for Kieffer. Differences in time of bloom between varieties is not great enough to be of practical importance. In general, then, it may be said that so far as is now known any variety will fertilize another, with the possible exception that in some localities Seckel will not fertilize Bartlett.

In some sections bees are rented at blossom time from bee-keepers to place in the orchards so as to increase set, while bouquets of blooms in pails through

the orchards have been used to advantage in solid blocks of one variety. Where no possibility of cross pollination is offered it is well to provide it. Top-working parts or all of some trees to other varieties can be successfully done with most varieties but not with all; bearing Kieffer trees which cannot be top-worked with any of the common European sorts, constitute the major exception. When a young orchard is planted full provision should be made for pollenizers. The ideal system is to have a pollenizer adjacent to every permanent tree, which means as a minimum every third tree in every third row. Where this is not practical because of difficulty in harvesting, four rows of one variety and one of another make a good combination. At all events the importance of cross-pollination should not be overlooked. It is a limiting factor in pear production in more orchards than is commonly supposed.

Nutrition—Yet after a blossom is properly fertilized it sometimes fails to set, a condition which is closely associated with the health and vigor of the tree and the food supply at blossom time. In order to set fruit a spur or a shoot must have a sufficiently high nitrogen supply. Trees which are low in vigor will therefore be improved by nitrogen applications about two weeks before bloom. Undoubtedly more nitrogenous fertilizers would be used were it not for the fear of inducing blight, and this is a proper precaution. Yet, starting with small applications, a

quickly available fertilizer will sometimes solve the problem.

Another way of arriving at much the same conclusion is by cutting out half of the old spurs and "drone wood" in the trees. Beurré d'Anjou and Seckel frequently bloom full and set light. By thinning-out spurs and old wood the vigor of the entire tree is thrown into the remaining parts, which then have sufficient vigor to set their fruit.

VII

DWARF PEARS

DWARF PEARS have been grown for over three centuries in Europe and over 100 years in America. They have always been popular in Europe and still retain their popularity there; while in America they were once quite highly regarded, then dropped into disrepute, and are now reaching a place of stability in which their value for some conditions is appreciated and their failure under others recognized.

A dwarf is a small growing tree, which is maintained as a dwarf by pruning and culture, by virtue of a slow-growing stock upon which it is propagated, or by a combination of both. The apple, pear, quince, hawthorn, and mountain ash are closely related and one may be worked upon another with varying results, some varieties doing well and others not so well. Since the quince has been used almost entirely as a dwarfing stock for pears, the terms "dwarf" and "quince" have come to be almost synonymous in pear literature. The distinction must not be lost sight of, however, that a dwarf pear need not necessarily be propagated upon

the quince, and also that a tree propagated upon the quince is not of necessity always a dwarf tree.

Dwarfing is done for several reasons. Its original interest was largely amateur in which growers of the pear in keeping with the times took keen interest in producing a great variety of fruits and some of exceptional size, quality, and flavor. The dwarf provided ideal conditions for the production of unusual forms, especially of some few varieties which seem endowed by nature to grow on the quince. Some of these are gritty and coarse on pear stock as the Duchess d'Angoulême or bitter and astringent as Louise Bonne de Jersey and Beurré Diel, but fine-textured and delicious upon the quince. Others, as the Glou Merceau do not ripen well in eastern America excepting on the quince. Late bearing varieties such as Beurré Bosc and Sheldon can be made to bear at an earlier age, some varieties producing fruit the first year after planting and others in three to five years. Further the dwarf tree is smaller and more manageable, and there is evidence to show that it is not so subject to blight as are free growing standards.

The practice suffered a severe reversal when dwarf trees because of individual successes came to be planted in a wholesale way with little regard to the attention which they demand. Frequent failures thereupon cast discredit upon the dwarf, but the reasons for failures as now understood are not valueless because they are guides for what not to do.

The most frequent cause of failure was through trees being worked upon poor dwarfing stocks. Another was shallow planting so that the quince root actually became a part of the trunk with resulting attacks by the quince borer and breakage at the point of union. High heading caused additional failures through uprooting by the wind, the quince being shallow rooted and the high heads offering good leverage. This combination of circumstances gave rise to the belief that dwarf pears are short-lived, while as a matter of fact under good conditions they have been known to live 100 years in France and 50 years in America. The horticultural literature in the middle of the 19th century is full of discussion of this subject, and the opinion of the leaders of that time is that failure was due largely to neglect of the little details of management which the dwarf pear demands.

At the present time dwarf trees are more fully appreciated for their true worth. They are properly regarded as objects of interest for the amateur lover of plants who derives pleasure from developing some of the finer horticultural products, and which can be attained only by close attention in this way. For the home orchard and the suburban garden plot they are very useful. The great commercial crop of America is borne on standard trees and their superiority for quantity commercial production is undisputed. Yet even in this field the dwarf tree has found a limited place, as for instance in certain sections of California where

the root aphis is severe. There, because the quince root is resistant to the louse, trees have been propagated using it as the stock. It is said that in 1920, nine per cent. of the trees in California were on quince roots. It is interesting to observe that since Bartlett, which is the leading commercial variety, does not do well on the quince, double-working is resorted to, in which the Beurré Hardy is first worked upon the quince and then Bartlett top-worked to this variety. The results have been satisfactory.

It has been intimated that quince roots are variable and that this fact is responsible for many failures. There are many types of quince and they have become seriously mixed, so that although quince roots are propagated by mounding and the resulting roots are the same as the parent plant, the stock taken as a whole is not uniform. The same pear variety may therefore be atrocious upon one quince root and happy upon another. Experience has shown that the free-growing Angers quince is the most satisfactory known at the present time. The development of an even better dwarfing stock would undoubtedly meet with high approval. It is a problem that may well receive scientific attention.

In general dwarf tree culture is similar to that of standards, with a bit more attention to details. The point is made by connoisseurs of fruits that the best things require close care, and that the dwarf pear being a delicate creation should be treated as it deserves. Be

that as it may, it is clearly a mistake to attempt to grow dwarf trees without adequate attention. Weeds and trash should never be permitted—thorough clean cultivation being most satisfactory although some very successful orchards have been grown under the sod mulch system. In those cases, however, special pains have been taken to keep the trees well mulched with straw and hay.

The soil should be fertile, preferably a silt loam or a clay loam. The quince is shallow rooted and will do well on more shallow soil than will standard pear trees, yet a soil which is noticeably shallow is often too shallow for success and is frequently dry and unfertile. The dwarf pear should not be considered under poor soil conditions because it will not succeed.

Because they are small, dwarf trees can be planted close together, resulting in a surprisingly large number of trees to the acre. Planted 15 feet by 15 feet the number is 193; 16 by 16 it is 170, and 14 by 14 it is 222. The first distance, 15 by 15, is about right, though some plantings have been made as close as 10 by 10 and 12 by 12. Planted 10 by 10 feet each way, 435 trees are required to the acre. They should be set three inches lower than the top of the quince stock, for as one writer has stated it "the quince is a root and not a trunk."

Correct pruning is very important. Without it a dwarf tree does not long remain a dwarf but tends to grow as a standard as roots are formed from the part

of the cion below the ground. At the same time a standard tree may be kept dwarfed by systematic pruning. The head should be formed at 18 to 24 inches from the ground and the tree shaped to a pyramid, meaning that the central leader will be maintained and the central-leader type will be followed. Trees two years old or older are desirable since early training can be carried on as well or better in the nursery than the orchard. Yet if low-headed trees cannot be secured from the nursery, yearling whips with buds low on their trunks are to be preferred. With six to nine branches as the framework of the tree the task is to keep the annual growth headed-back about one-half each year, cutting a trifle more severely in the upper laterals than on the always less vigorous lower ones with the exception of the leader, which is allowed to continue growth only partially checked. Crowded lateral shoots must, of course, be thinned out. By this method a compact, small pyramidal tree will be formed which will be both ornamental and productive.

In some sections of America there has been a tendency to develop a broader flatter-topped type tree for the commercial orchard. The principle of pruning is the same excepting that the broadening of the lower branches and the low height of the top are carefully encouraged, the leader being more severely checked so that eventually the original pyramidal

shape becomes more that of an inverted cone. Trees are kept under 12 feet in height.

It has been said that some varieties do well on the quince and that some do not. In addition some varieties which are not suited to the quince may be improved by double working as has already been described for the Bartlett in sections of California where the root aphis is severe upon pear roots; Beurré Hardy, which makes a good union with the quince, being first worked on the quince stock and then in turn top-worked to Bartlett. This same method may be used with other varieties.

Following is a list of common varieties arranged according to their performance upon quince roots. Those that are starred have proven especially suitable for dwarfing, all things considered.

Succeeding better on the quince than on the pear—

Beurré Diel
*Duchess d'Angoulême
Easter Beurré
*Glou Morceau
*Louise Bonne de Jersey
*Vicar of Winkfield

Succeeding well on both the quince and the pear—

*Beurré d'Anjou
Beurré Clairgeau
Beurré Hardy
Beurré Superfin
Bloodgood
Jargonelle
Josephine de Malines
Lamy
Madeleine
Osband

Buffum
Colmar
*Elizabeth
Flemish Beauty
Forelle
*Howell
Pound
Rosteizer
*Tyson
Urbaniste
*White Doyenné

Succeeding on the quince but better suited to the pear—

Bartlett
Belle Lucrative
Beurré d'Arenberg
Doyenné Boussock
Gray Doyenné
Kingsessing
*Lawrence
Onondaga

Succeeding on the quince only when double-worked—

Beurré Bosc
Columbia
Dix
Dunmore
Marie Louise
Seckel
Sheldon
Washington
Winter Nelis

VIII

COMMON DISEASES AND INSECTS AND THEIR CONTROL

Diseases and insects play a larger part in commercial pear production than in any other orchard fruit. This is so not so much because of the number of pests which attack as for the intensity of two or three, principally pear blight and pear psylla, which almost defy control and are limiting factors in pear production. Fortunately careful study of the life histories of these various pests has revealed critical periods in their development during which they are most easily destroyed by means now available. An understanding of the principles of each is essential, a few of the most important being discussed in this chapter.

Diseases

Diseases are caused by minute plant-like growths which live upon the fruit and the tree. They are grouped into bacterial diseases, which are caused by bacteria and which are difficult of control, and fungous diseases, which are caused by fungi and are more easily controlled.

Pear Blight—Of all diseases common to fruit trees, pear blight or fire-blight (*Bacillus amylovorus*) has been more discussed with less progress in its control than any other. It is notorious as the first plant disease to be recognized as caused by bacteria. Because of its infectious and virulent nature it is extremely difficult to control, and it is doubtful if there is an orchard in eastern pear growing sections and only a few in western regions which have not been attacked by it at one time or another. Blight develops very rapidly when conditions are favorable, some idea being grasped of its virulence by the fact that a single bacteria may develop by division and redivision during twenty-four hours of optimun conditions to give ten million others. Periods of warm moist weather are especially favorable.

The most striking symptoms of attack occur during the growing season when dark brown dead leaves on spurs, twigs, and branches show up plainly in contrast with healthy green foliage. The margin between diseased and healthy tissue is not sharply defined at this stage but in general the affected bark is darker in color and reddish brown beneath. As tree growth slows up the lines of demarcation become clearer until during the growing season a crack separates the healthy from the diseased part. These spots are known as cankers and are the source of infection for another year. On older branches and on the trunk they are seen as sunken areas, from which a diseased shoot or

spur springs showing clearly that the organism gained entry into the larger branch by way of those growths. The cankers are dry and dark and the wood beneath is brown and dead.

When blossoms are attacked they also brown and wither. On the fruit the symptoms are soft brown water-soaked patches exuding drops of sticky gray matter, later forming an amber-colored mass, the fruit shrinking to a brown mummy.

Any affected part may be a source of infection, especially the holdover cankers. During warm moist weather the bacteria become active and spread to adjacent healthy tissue, oozing out from breaks and lenticels in the bark as a sweet thick milky substance to which bees and other insects are attracted. It is mostly by means of insects that the blight organism is spread, gaining entrance to new growth once more through blossoms, tender new growth, or any abrasion in the old bark. It may also be introduced on pruning tools and by mechanical injuries which occur while working the orchard.

Apparently all cultivated varieties are susceptible to the disease, even the Kieffer variety. Clapp Favorite seems especially susceptible and Bartlett and Howell are not far behind. On the other hand Seckel and Tyson are resistant, while Kieffer is often spoken of as "blight proof." That it is not immune to blight attack is evidenced by the fact that in the southern

United States Kieffer pear culture has been almost wiped out by the disease.

The difference in so-called resistance seems correlated with the length of the active growing period—varieties which are relatively resistant being largely either slow growing or making a quick growth and then slowing up, as does Kieffer. When conditions are right, Kieffer is far from being immune to blight. Obviously the longer the period of vigorous growth the more chance there is for infection. Judged in the light of this theory, trees in sod should be less susceptible to blight, as should also dwarf trees and the slow-growing Seckel. Experience shows that this is actually the case.

It will be seen at once, then, that control consists in removing the source of infection, for there is no spray or antiseptic treatment that has yet proven its value to destroy the organism in a wholesale manner. The plan should be first of all to cut out all diseased parts as quickly as they are seen, and since blight may spread very rapidly under favorable conditions close watch should be kept during warm moist periods. All cuts should be made at least six inches below all visibly diseased areas and disinfected with corrosive sublimate, one tablet to a pint of water, which may be carried in a bottle and applied with a sponge to which a string is tied. All cankers should be carefully cut out during the dormant season and any badly diseased branches removed well below the infection. All dis-

eased wood should be removed from the orchard, and preferably destroyed.

Fire-blight is much more severe in California and southern Oregon than in the northern pear sections of the East, yet it does more damage in the East than in the West. The reason is that in western pear sections regular patrols are maintained to watch for blight. Experts are trained for this particular work, one man being assigned to about forty acres, or more men if needed, and every effort made to eradicate the disease. As a result blight is controlled. In the East, however, where blight is only a periodic menace little or no systematic effort is made to control it and damage is done before it is fully appreciated. More attention to the details of blight removal would be amply rewarded.

Scab—Pear scab (*Venturia Pyrina*) is not of great importance in regularly sprayed orchards but in unsprayed ones it is serious, especially on the Flemish Beauty variety. Other susceptible sorts are Beurré d'Anjou, Beurré Clairgeau, Duchess d'Angoulême, Lawrence, Seckel, Sheldon, and Summer Doyenné. Kieffer and Le Conte are seldom attacked, and Bartlett is somewhat resistant.

The disease, which has much the appearance of apple scab, is caused by a different fungus. It differs from apple scab mainly in its prevalence upon twigs, where it is found as dark rough blisters which are grown over on older wood by healthy bark. On the

fruit it forms blackish irregular splotches which may cause the fruit to crack and to be malformed and russeted. Infection on the leaves is characterized by dark blotches. In April or May spores shoot from the over-wintering lesions on twigs and fallen leaves and infect the new growth. Cool moist periods are especially favorable to its development.

Control is not difficult in regularly sprayed orchards excepting with such susceptible varieties as Flemish Beauty and Winter Nelis. In the case of the former its susceptibility to the disease has resulted in its being no longer largely grown.

Recommendations call for spraying (1) when the petals show pink but before the blossoms open; (2) soon after the petals fall, and (3) about two weeks later. In the far West a dormant spray is advised to kill the fungus on the twigs. Materials may be either lime-sulfur 1-50, bordeaux mixture 3-3-50, or dry-mix.

Leaf-Spot—Leaf-spot, ashy leaf-spot, or septoria leaf-spot, as it is variously called, is recognized by small brown roundish spots, ranging in size from bird shot to a pea, with a characteristic grayish white dot at the center. The fungus (*Mycosphaerella sentina*) lives over winter on fallen leaves and attacks the new leaves in early spring. It is controlled by regular spraying for pear scab and is therefore not of great importance in sprayed orchards. It is most severe upon nursery stock and such susceptible varieties as Bartlett, Beurré

d'Anjou, Beurré Bosc, Seckel, and Sheldon. Beurré Clairgeau, Duchess d'Angoulême, and Flemish Beauty are relatively resistant, while Kieffer, Lawrence, and Mount Vernon are almost immune. The greatest damage comes through premature dropping of the leaves, which means checking of the growth and often winter injury to the resulting weak growth.

Leaf Blight—This disease (*Fabraea maculata*) is distinguished from leaf-spot by the more circular outline and reddish color of the spots, which may merge with others to form larger brownish areas with small black raised dots at their centers. It is caused by a fungus which winters over either on infected twigs or fallen leaves and which attacks the leaves, twigs, and fruit. Seriously affected leaves turn yellow and drop. Fruit that is attacked shows red and brown spots, is roughened, and the skin may crack. Beurré Bosc, Clapp Favorite, Duchess d'Angoulême, Flemish Beauty, Kieffer, and Lawrence are all resistant, while Seckel, Sheldon, and Wilder Early are more subject to its attacks. Injury comes from loss of the leaves in early season, as well as possible loss through damaged fruit. Control is not difficult, using lime-sulfur or dry-mix in early spring as recommended for pear scab.

Red Leaf—The foliage of pear trees, especially Kieffer, Seckel, and Beurré Clairgeau, sometimes becomes reddish or bronze-color in mid-summer. Usually the trouble is confined to scattered individuals,

often in low places or on shallow soil. Apparently it is not caused by any specific organism. Practically every instance so far examined has been traced to drouth, winter cold, borers, mouse injury, mechanical injury to the roots or trunk, and agencies of that kind. Control lies in good orchard management.

Insects

Insects may be divided into three classes according to their manner of feeding (1) Chewing, (2) Sucking, (3) Lapping. Chewing and lapping insects are controlled by stomach poisons and are for the most part not difficult of control. Sucking insects, however, which suck the juices of the plant are difficult to combat, most reliance being placed upon materials which kill either by contact or by fumes.

Pear Psylla—Pear psylla (*Psylla puricola*), pronounced as though spelled "sylla," is the most difficult to control and most widespread in its injury of any pest in eastern pear orchards. The adult has been likened to a diminutive cicada in its appearance and to an aphid in its sucking habit. It has also been called a "winged aphid"—both descriptions serving fairly well to distinguish it. The winged adults hibernate in crevices in the bark or under old leaves and trash, and in the spring come from their places of shelter and lay eggs on the twigs and developing buds.

The tiny yellow eggs are found in great numbers on the twigs and spurs and in about three weeks they

hatch into small almost colorless young, called "nymphs," which are very difficult to see without the aid of a magnifying glass. Clustered about the axils of the leaves and at the bases of the blossom clusters they suck the juices of the plant and seriously weaken it. A small droplet of a sweetish liquid, called "honey dew," is soon found covering them and may become so abundant as to almost cover the foliage and even drop to the ground. Honey dew is an excellent medium for the growth of the sooty blotch fungus and soon the foliage, wood, and fruit are blackened with it, often the first indication that a grower receives that psylla is present.

Throughout the summer the pest continues the development of the cycle: egg, nymph and adult, so that all forms are present at most periods during the season and so that no one treatment appears to give complete control under all conditions. The weakening of the tree after repeated attacks results in poor set of fruit and low yields, while at the same time the fruit is spotted and brings a poor price.

A number of control measures are suggested, any one of which may prove to be the important one in any single year, depending upon weather and the development of the insect. They are: (1) Clean cultivation and general clean-up of trash. (2) Scraping of the bark to destroy winter quarters. (3) Spraying for the adults with 3 pounds of soap and ¾ of a pint of nicotine sulfate in 100 gallons of water during a warm

quiet spell in November or December or in March or early April. Miscible oil may also be used. (4) Spraying with lime-sulfur 1 to 8 to kill the eggs in early spring when the flower clusters have just separated. (5) Spraying to kill the newly hatched nymphs just after the blossoms have dropped with 1 pint of nicotine sulfate, 30 pounds of hydrated lime, and 2 pounds of copper sulfate in 100 gallons of water. (6) Dusting with nicotine dust in mid-summer against the adult flies.

Growers have placed greatest dependence upon treatments 4 and 5, though the foliage burning accompanying treatment 4 has led some to adopt treatment 5, repeating it during the summer as needed. More recently a combination of 10 pounds of plaster of Paris, 40 pounds of hydrated lime, and a pint of nicotine sulfate has been used as a dust during the summer with fair success.

San Jose Scale—San Jose scale (*Aspidiotus perniciosus*) is found on both tree and fruit, in severe cases encrusting the branches and twigs with its gray-ash scales and malforming the fruit. The myriads of minute insects responsible for the damage are found beneath round, shield-like scales. They reproduce rapidly during the summer, and, since summer spraying is unsuccessful in controlling them, they gain a strong foothold by fall. Thorough spraying with lime and sulfur, 1 to 8, either in the winter or just as the

buds are swelling, is the recommended means of control.

Codling Moth—The codling moth (*Carpocapsa pomonella*) is destructive to the fruit of the pear. Two or three weeks after the trees have bloomed, the larvæ hatch from the small eggs laid by the mother moth. The young worms crawl to the calyx end of the small fruits and enter. Control measures, then, are directed toward a thorough application of lead arsenate at the rate of 2 or 3 pounds to 100 gallons of water about the time the petals have fallen. Where a second brood develops, usually in late July or August, an application may be necessary in time to cover the fruit before the worms begin to hatch.

Pear Thrips—In some sections the pear thrip (*Taeniothrips pyri*) causes much damage to blossoms. The insects pass the winter in small earthen cells 3 to 4 inches underground, from which they emerge as adults early in the spring just as the buds are breaking and tear and rasp the tender parts and suck their juices. The eggs which they lay hatch in three or four days, and after feeding for two or three weeks, the larvæ fall to the ground to take up their winter quarters. The damage is especially severe upon the pear because the blossoms are in clusters. Control measures consist in spraying as the first buds are opening with 1 pint of nicotine sulfate and 5 gallons of miscible oil in water to make 100 gallons. It will be recognized at once that one of the best control

measures is directed at the cells in the soil. Consequently plowing and cultivating will do much to check the thrips.

Pear Slug—Small, shiny, black slugs (*Eriocampoides limacina*) are often found eating the pulp from the leaves, leaving a skeleton network of veins. They may be readily controlled by dusting the foliage with hydrated lime. They are of no importance in sprayed orchards.

Blister Mite—Blackish patches or blisters on the foliage are caused by the blister mite (*Eriophyes pyri*), a microscopic creature which burrows into the leaves and irritates the formation of the gall-like blisters. Winter strength lime-sulfur applications as for scale and psylla control the mite. A special spray of lime-sulfur 1 to 15 applied in early spring before the leaves have opened may be necessary where no other applications are made.

Pear Midge—No satisfactory remedy is known for this pest (*Contarinia pyrivora*). Eggs are laid in the young fruits in early spring from which small white maggots develop and which infest affected fruits in large numbers, causing them to drop and to be malformed. An entire crop may be lost by these attacks. Thorough cultivation in June and July has been suggested as a helpful measure.

Materials

Arsenate of lead is the standard stomach poison, and nicotine sulfate the most common material for sucking insects. As contact insecticides lime-sulfur and oil sprays are most relied upon, while for fungous troubles lime-sulfur and dry-mix are standard. All of these materials are usually secured from commercial manufacturers and their preparation will not be discussed here. Because of the injury to foliage which is not uncommon when lime-sulfur is used, dry-mix has come rapidly to the front as a desirable fungicide for the pear. It is prepared by first mixing 8 pounds of hydrated lime, 16 pounds of finely divided sulfur, and ½ pound of calcium caseinate, and then mixing the whole in water to make 100 gallons.

Spray Schedule—It is desirable to combine as many of these sprays as possible into what may be called a spray schedule though the schedule for one locality may not fit another. A commercial schedule applicable to many pear sections is as follows:

(1) Delayed dormant spray—applied just as the bud scales begin to separate, 5 gallons of miscible oil and 1 pint of nicotine sulfate with water to make 100 gallons, directed against pear thrips.

(2) Cluster bud spray—applied when cluster buds are separating, 11 gallons of lime-sulfur in water to make 100 gallons, directed against scale, scab, and psylla eggs.

(3) Calyx spray—applied just after the petals fall, 8 pounds of hydrated lime, 16 pounds of superfine sulfur, ½ pound of calcium caseinate, 1 pint of nicotine sulfate, and 2½ pounds of powdered lead arsenate in water to make 100 gallons, directed against codling moth, psylla nymphs, and scab.

Another schedule for sections where psylla and thrips are not serious is:

(1) Dormant spray—applied before growth starts in the spring, lime-sulfur 1 to 8 or miscible oil 1 to 15.

(2) Cluster-bud spray—applied when the clusters have separated, dry-mix and 2½ pounds of arsenate of lead to the 100 gallons of solution.

(3) Calyx spray—applied just after the petals have fallen, dry-mix and arsenate of lead as given for the cluster-bud spray.

(4) Three weeks after the petals fall—dry-mix and arsenate of lead at the proportions already given.

IX

VARIETIES OF PEARS

THERE are in the neighborhood of 5,000 varieties of pears recorded in horticultural literature, running the gamut of flavor, flesh texture, size, shape, and season, not to mention tree characters. From this number about seventy-five have been picked for brief discussion, aiming not so much to give all the available facts about each one but more to touch upon the points that are of most value. For example Bartlett is the leading commercial pear, Beurré Clairgeau is attractive but drops badly, Seckel has a touch of romance connected with it, and Winter Nelis is a good pollenizer. In addition an attempt has been made to group a few varieties for special purposes or because of certain characters, as high quality, suitable as dwarfs, important commercially, and blight resistant. A few selections follow.

Ten leading commercial sorts: Bartlett, Kieffer, Seckel, Clapp Favorite, Beurré d'Anjou, Beurré Clairgeau, Winter Nelis, Flemish Beauty, Doyenné du Comice, Howell.

Ten suited to the home orchard: Bartlett, Seckel,

Clapp Favorite, Beurré Bosc, Winter Nelis, Dana Hovey, Tyson, Elizabeth, White Doyenné, Bloodgood.

Ten blight resistant sorts: Kieffer, Garber, Le Conte, Sudduth, Seckel, Tyson, Duchess d'Angoulême, Buffum, Doyenné Boussock, Beurré Giffard.

Ten hardy varieties: Flemish Beauty, Idaho, Beurré d'Anjou, Sheldon, Seckel, Tyson, Winter Nelis, Lawrence, Buffum, Duchess d'Angoulême.

A succession for the home orchard: Elizabeth, Tyson, Clapp Favorite, Bartlett, Seckel, Beurré Bosc, Dana Hovey, Winter Nelis.

Anjou—See Beurré d'Anjou.

Ansault—This is distinctly a home orchard variety of high quality. The fruit is medium in size, obtuse-obovate-pyriform, short-stemmed, greenish yellow with russet markings, in season in late September and early October. The tree is vigorous, productive, and fairly blight resistant.

Bartlett—Bartlett is far and away the leading pear in America for all purposes—shipping, home use, and canning. Its large, uneven surfaced, yellow fruits, oblong-obtuse-pyriform in shape, with melting, juicy, characteristic aromatic flesh, are very good in quality and in season in September. The trees are vigorous and early, regular, heavy bearers though they blight easily and are only half-hardy. Their chief virtue is that they do well under a wide range of soil and climatic conditions.

Belle Lucrative—Here is another pear of high

FIG. 7—A STUDY IN BLIGHT RESISTANCE

In a varietal plantation the Seckel and Kieffer trees in the background have survived while stumps in the foreground are all that remain of the Clapp Favorite and Howell trees planted at the same time

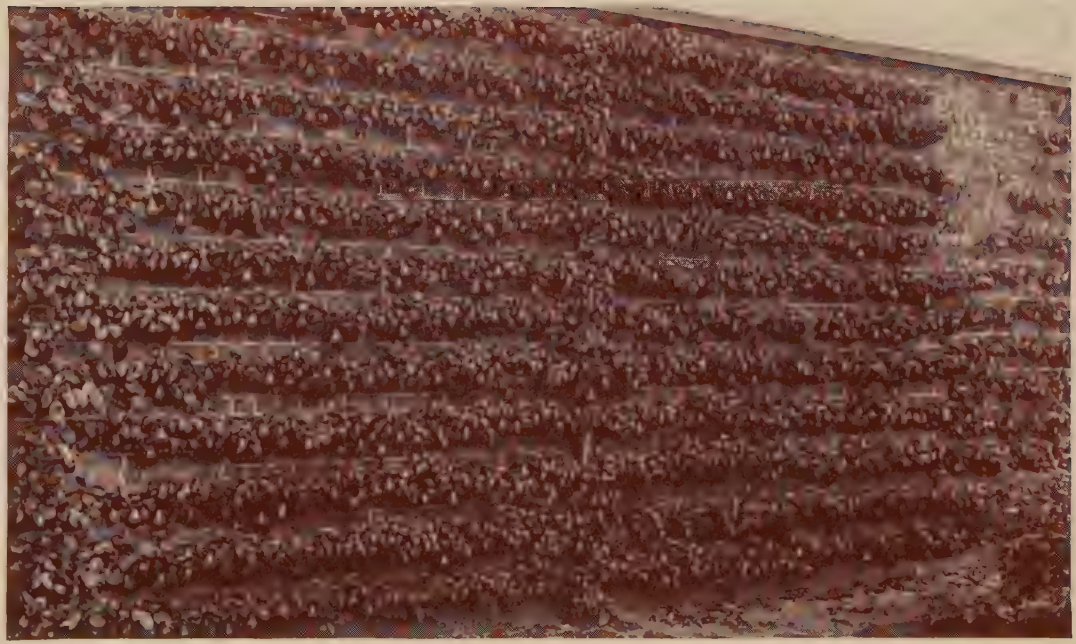

FIG. 8—A VERY SUCCESSFUL ESPALIER PEAR TREE

quality for the home orchard, in season in late September and October. The turbinate fruits are greenish-yellow with small russet dots, the calyx being large and open. The trees do well on both quince and standard roots and are easily managed. They bear early and heavily.

Bessemianka—The only reason for including this sort is because of its hardiness and drouth resistance. It is the leading pear found in Russia and has been suggested for colder sections of America. The fruits are large, roundish-obovate, not high in quality, in season in October.

Beurré d'Anjou—When it bears Anjou, as it is more commonly called, is one of the most profitable varieties because it is an attractive winter pear of high quality. The fruit is large, regular, with short thick stem and characteristic open, star-shaped calyx in a shallow, narrow basin, with buttery, juicy flesh, in season in November and December. Though having a vigorous spreading tree and one somewhat more hardy and more blight proof than others, Anjou is not extensively planted because of its later and unreliable bearing. On the Pacific Coast, where it is highly regarded, attempts are being made to remedy this fault.

Beurré d'Arenberg—This winter pear requires a long season and does not mature well in the East. It is best suited to the Pacific Coast. The fruits are large, obovate-pyriform, yellow, with russet markings,

very good in quality, in season in December and January. The trees are hardy and productive.

Beurré Bosc—Bosc is one of the standard market pears in season in late October and November. Its large size, long tapering shape, long curved stem, beautiful bronze color, and superb quality mark it as one of the finest of pears. The trees are slow to take hold in the orchard, subject to blight, and not hardy, yet they are regular and heavy bearers once they fruit. Bosc is an old variety meeting with new favor.

Beurré Clairgeau—This variety is characterized by a particularly fine tree, with strong, healthy foliage, ordinarily quite free from blight, and bearing large crops regularly. But unless the fruit is thinned it is apt to overbear and the fruit does not hang well, especially in dry seasons. The fruit is large, roundish-acute-pyriform, attractive pale yellow with pinkish red cheek and a characteristically short, stout stem set at an angle. The flesh is firm, granular, and only fair in quality, in season in late October and November. Clairgeau is one of the standard late fall and early winter market pears.

Beurré Diel—Here is a variety which is better suited to the quince than to standard roots in America. The fruit is large, obovate-obtuse-pyriform, greenish-yellow with faint red blush, and very richly and highly flavored. It is in season in November. The trees are productive but susceptible to blight.

Beurré Giffard—Giffard is a summer pear ripen-

ing several weeks before Clapp Favorite which could well be more extensively grown than it is. The fruit is broad, acute-pyriform, greenish-yellow, long-stemmed, with flesh of high quality but which softens rather quickly in common with most pears of its season. The tree is a vigorous, spreading grower, hardy and blight resistant.

Beurré Hardy—The chief virtue of this variety is to work upon the quince and then in turn be top-worked to some sort which does not do well on the quince. The trees are vigorous, healthy, and productive. The fruit is large, obtuse-pyriform with long neck, short stem, and large open calyx. It is high in quality and in season in late September and early October. On the Pacific Coast it is considered a good export variety but is not widely planted.

Beurré Superfin—This variety is primarily for the home orchard. The tree is vigorous and productive although late to begin bearing. The fruit is among the highest in quality of all pears but it is not attractive in appearance. It is large, roundish-oblate with short, thick, rounded neck, and in season in October. Superfin is considered one of the best for working upon the quince for dwarfing purposes.

Bloodgood—Bloodgood is recommended as a summer pear for home orchards by a good tree and high quality fruits which are medium in size, roundish-pyriform in shape, long-stemmed, and high quality, in season in late August.

Bosc—See Beurré Bosc.

Boussock—See Doyenné Boussock.

Buffum—This variety is of value where vigor, hardiness, and health of the tree are essential. The fruit is medium in size, oblong-obovate-pyriform in shape, brownish-yellow with red blush, variable in quality, in season in late September and October.

Clairgeau—See Beurré Clairgeau.

Clapp Favorite—Clapp Favorite heralds the commercial pear crop with its large yellow, red-blushed, obovate-pyriform fruit with characteristic fleshy ring about the stem. The flesh is melting, juicy, very good in quality, in season in late August and early September. The tree is vigorous and a regular heavy bearer, yet it is so subject to blight that it cannot be grown in many localities. Where blight can be controlled, it is a desirable sort; otherwise, not.

Comice—See Doyenné du Comice.

Conference—A new pear in America and one grown extensively in England for market, Conference is receiving attention in America. The fruits have pinkish flesh, are above medium in size, smooth, somewhat long, greenish, dotted with russet, good in quality, and in season in October and November. The tree is very productive but only a moderate grower.

Dana Hovey—This little pear with its attractive yellow coloring and sweet, delicious flavor is rated one of the best of all pears. The fruit is small, obovate-obtuse-pyriform, golden-yellow, in season in late Oc-

tober and November. Were it not that the tree is only moderately productive and is prone to blight, Dana Hovey would be more extensively grown.

Dearborn—Dearborn is an old favorite whose popularity is on the wane. The fruit is roundish-pyriform with a slight neck, small, dull, good in quality, in season in late August following Bloodgood. The trees are healthy and productive, adapted to the home orchard.

Dix—This is a large, oblong, high quality sort especially suited to working on the quince. Its season is October and November.

Dorset—Dorset is much like Seckel in shape and color, but broader in shape, larger in size, later in season, and with a long curved stem. The tree is slow growing but healthy and productive so that Dorset is valuable to follow Seckel.

Douglas—This variety belongs to the group of hybrid pears characterized by Kieffer and is of value only in sections of heat and blight where a variety of this type with better than average quality is desired. The fruit resembles Kieffer and is ripe in October. The trees are productive but not so vigorous as those of Kieffer.

Doyenné Boussock—If some of the excellent tree characters of this variety could be combined with quality fruit, Boussock would be one of the leading sorts because of the vigor, health, and productiveness of the trees and the freedom of the fruit from insect and

fungous attack. Unfortunately the fruit, which is characterized by its roundish-obovate shape, numerous rough dots, and open calyx, is only average in quality and softens at the core. Nevertheless the ease with which it is managed commends it. The season is early September.

Doyenné du Comice—This variety, which is one of the finest of pears, is slowly growing in commercial importance on the Pacific Coast, though the tenderness of the tree, susceptibility to blight, and shy bearing under eastern conditions have prevented its gaining in the East. The fruits are large, obovate-obtuse-pyriform with long stem, clear yellow blushed with red, in season in late October and November.

Drouard—See Président Drouard.

Duchesse d'Angoulême—Duchess is more commonly dwarfed by grafting on the quince than any other sort and does very well. The trees are healthy and productive, producing very large, obovate, knobby, greenish fruit with short, stout stem. The quality is good; the season, October and November.

Duhamel du Monceau—This variety is characterized by medium-sized, russeted, oblong fruits which are very good in quality, in season in October and November. They are of the same type as Winter Nelis and the tree is if anything better than that variety, yet the size and appearance of the fruit have not made it successful.

Early Harvest—The vigorous, healthy trees of this

variety have met with favor in the middle West where these attributes are essentials to success. In other sections the poor quality of the fruit and its quick softening at the core have condemned it. In appearance the fruit is large, obovate-obtuse-pyriform, with fleshy stem set at an angle, ripe in August.

Easter Beurré—The fruit of Easter Beurré is large, obovate-pyriform with short thick neck, short stemmed, yellow marked with russet, good in quality, and in season from late December to February. The trees are exceptionally vigorous and healthy, yet they are insistant upon warm soils, a warm climate, and a long season so that planting has not been wide. The variety does well in some sections on the Pacific Coast and is there highly esteemed as a pollenizer for Beurré d'Anjou.

Elizabeth—Mannings Elizabeth, with its small, roundish bright red fruits, is one of the most attractive of summer pears. The quality is very good and the season late August. The trees are healthy and productive so that Elizabeth is highly regarded as an early summer sort.

Flemish Beauty—This variety is perhaps the most easily disfigured by scab in both tree and fruit of all pears. Moreover the trees blight badly so that Flemish Beauty has been all but eliminated. The fruit is large, obovate-obtuse-pyriform, dull yellow, blushed with red on the exposed cheek, very good in quality, in season in late September and early October. It is

probably the hardiest good pear known at the present time, and is receiving attention in commercial pear sections of the Pacific Northwest.

Forelle—The fruit of this variety is medium in size, oblong, yellow overlaid with pinkish-red and covered with conspicuous dots which give it its German name, translated "trout." The trees are very subject to blight, yet the attractive appearance of the fruit has made it a profitable sort on the Pacific Coast.

Garber—Here is another hybrid pear belonging to the same group as Kieffer and much resembling it. Because it is more tolerant of heat and cold than is Kieffer it takes the place of that variety in sections of the Mississippi Valley.

Giffard—See Beurré Giffard.

Glou Morceau—Trees of this variety are vigorous, spreading, and productive but require a long growing season in which to mature their dull greenish-yellow fruit. The shape of the fruit is obovate-obtuse-pyriform; the quality, good; the season, November and December. Glou Morceau does very well as a dwarf on the quince.

Gorham—This is a late Bartlett-type pear produced by the N. Y. State Agricultural Experiment Station from a cross between Bartlett and Josephine de Malines and recently offered for trial. The fruits resemble Bartlett in general size, color, and shape, though somewhat longer and more tapering towards

the stem and from two to four weeks later. The trees appear healthy and hardy.

Hardy—See Beurré Hardy.

Howell—The roundish pyriform fruits of Howell are uniform, medium in size, lemon-yellow with faint blush, very good in quality, and in season in late September and October. Though the trees are very productive they blight badly and are little planted outside of the Pacific Coast States.

Idaho—The fruits of this variety are almost globular, russeted, good in quality, in season in late September and October. The trees are very hardy and productive but subject to blight. Idaho has not met with great favor save where hardiness is essential and blight control is not difficult.

Jargonelle—Here is a variety that dates its origin back to before the time of Christ. It has long been esteemed as an early high quality fruit, yet newer, better sorts are taking its place. The fruit is medium in size, yellow with reddish blush, oblong with an acute neck, in season in late August and rotting quickly at the core. The trees are long-lived and fairly productive.

Josephine de Malines—Healthy, vigorous, productive trees and interesting high quality fruits commend this variety to the home orchardist and possibly the commercial grower. The flesh is pinkish; the shape, turbinate with long stem; the color, greenish-

yellow; the season, December to February. It does well on the quince.

Kieffer—It is doubtful if any pear has been condemned as freely and yet praised as often as Kieffer. Those who have decried it have compared it with finer dessert sorts while those who have praised it have considered it from a money-making viewpoint. There is no question that the oval, yellow, granular fruits are poor for dessert; but on the other hand, they are very good for culinary use, and they can well. Moreover the trees are especially vigorous, bear profitably, resist blight and scale, and endure heat and drouth. For sections where these are most important Kieffer has a place, but where better sorts can be grown it has none. The season is late October to December.

Kingsessing—This variety is grown in a limited way along the Atlantic Coast south of New York. The fruit is medium in size, obovate-obtuse-pyriform, dull yellow, only good in quality, in season in September and October. The trees are exceptionally vigorous, hardy, and productive but the variety falls short of being successful.

Koonce—Here is another summer pear of the same type as Early Harvest and Lawson, and like them rotting quickly at the core. The trees are vigorous, healthy, and productive though slow in coming into bearing. The fruits are medium in size, obovate-obtuse-pyriform, greenish-yellow with reddish-brown

blush, good in quality. Koonce is scattered through most pear sections but not extensively grown.

Lawrence—This is an early winter pear of good quality, now considered of greatest value as a home orchard variety, being barred from commercial markets by poor size, poor color, and only moderate productiveness. The fruits are characterized by their obovate-obtuse-pyriform shape flattened at the stem end, lemon-yellow color, and season during November and December. The tree is one of the hardiest among pears.

Lawson—Comet is another name for this variety, which because of its extreme earliness and bright attractive appearance is grown, especially on the Pacific Coast, to supply the early markets. The fruit is large, obtuse-pyriform with short thick stem, yellow overspread with bright pinkish-red blush, poor in quality, ripe in early August. The trees are healthy and productive.

Le Conte—Here is another Kieffer-type pear, differing from Kieffer mostly in its adaptability to even warmer climate and lighter soil, so that it has a place in southern pear sections. It ripens ahead of Kieffer and is poorer in quality.

Lincoln—This variety is essentially a middle Western one, where because of health of tree, in spite of heat, cold, and blight, it has met with favor. The fruit is moderately large, roundish with obtuse taper-

ing neck, greenish-yellow with conspicuous dots, only good in quality, ripe in late August and September.

Lincoln Coreless—This is a very large, obovate-acute-pyriform fruit with long curved stem, so much resembling Pound that its identity has been questioned. The color is greenish-yellow with pinkish-red blush; quality, poor; season, February. The trees are healthy and productive.

Louise Bonne de Jersey—This variety grows as well or better on the quince than on the pear and is consequently esteemed by the amateur. It is an oblong fruit with rather long curved stem fleshy at both ends; yellow in color with red cheek; high in quality; in season in October. The trees are not very hardy and are subject to blight, but they are good croppers and vigorous growers.

Lucrative—See Belle Lucrative.

Madeleine—Madeleine is the best very early pear now grown and as such is desirable for the home orchard. The fruits are small, roundish-obtuse-pyriform, flesh drawn up on one side of the stem, dull green, in season in early August. The trees are healthy and dependable.

Marie Louise—Here is a delicious fall pear for the pear fancier. The fruits are above medium in size, oblong-pyriform, rich yellow, in season in late September and early October. The trees are slow growing and not dependable croppers though hardy and healthy.

Mount Vernon—The small, good quality, oblong, greenish, russeted fruits of this variety are in season in late October and November. The trees are large, vigorous, and healthy, so that where a reliable pear of this type is desired Mount Vernon may well be used.

Onondaga—Known to many as Swan's Orange, this variety is rapidly passing because of its susceptibility to blight. The fruit is above medium in size, obovate-obtuse-pyriform, rich pale yellow, very good in quality, in season in early October.

Osband Summer—Osband is included here only because it is still found in many eastern orchards. It is rapidly passing. The fruits are small, obovate, yellowish-green with brownish cheek, richly flavored, in season in early August. The trees are good on both pear and quince stock, healthy, and dependable.

Passe Colmar—The vigorous, healthy, productive trees of this variety do well on the quince or as standards on light, warm soil. A tendency to overload produces small, poorly matured fruits, but if these conditions are taken care of the fruits are delicious and interesting. They are medium in size, obovate-obtuse-pyriform, greenish-yellow with russet markings, in season in December and January.

P. Barry—Here is one of the latest winter pears known, increasing in importance on the Pacific Slope. The fruits are medium in size, oblong-obtuse-pyriform, rich yellow covered with russet, good in quality, in season in November and December but keeping until

March, April, and even May. The trees are very hardy, not overly vigorous, but productive.

Phelps—Phelps is the product of a cross between Winter Nelis and Russet Bartlett made at the N. Y. State Agricultural Experiment Station and recently offered for trial. The fruit is similar to Bartlett in size, shape, and color, but is more blocky, a trifle duller, and in season in late November and December, more than two months later than Bartlett. The trees appear healthy and productive.

Pineapple—This is a recent addition to the list of pear varieties for southern states. It is said to be adapted to southern sections and free from blight.

Pitmaston—Here is another popular English pear requiring either a long growing season or a warm, light soil. The trees are vigorous and healthy and the fruit large, Bartlett-shape, lemon-yellow, very good, in season in October. It recommends itself for commercial planting where it does well, and is especially suited to the quince.

Pound—The largest fruits known are those of Pound—obovate-acute-pyriform, with long curved stem—a variety which dates its origin back before the time of Christ. The quality is poor; the season, February. The trees are healthy and productive.

Président Drouard—Drouard, as the variety is often called, is susceptible to blight but is otherwise promising as a new sort for American conditions. The fruit is large, oblong-obovate-pyriform, dull lemon

yellow with russet markings, good in quality, in season in late November and December.

Pulteney—Here is another late Bartlett type originated by the N. Y. State Agricultural Experiment Station from a cross between Winter Nelis and Russett Bartlett. The fruit resembles Bartlett in size, shape, and color, but is a month to six weeks later in season and perhaps duller in color. The trees seem healthy and productive.

Roosevelt—Roosevelt was introduced in 1905 and widely advertised but it has so far failed to perform as was expected of it. The fruits are only medium in size, roundish-obtuse-pyriform, lemon-yellow with russet markings, fair in quality, in season in late September and October. The trees are large, vigorous, and productive.

Rostiezer—This delicious little pear is especially suited to the home orchard where a Seckel-type fruit is desired in August. It is small, obovate, greenish-yellow, with long slender stem. The trees are healthy, productive, and do well on the quince.

Rutter—Rutter is found here and there about the country, with vigorous, blight-resistant tree, but condemned by uncertain bearing. The fruits are large, roundish-obtuse-pyriform with thick blunt neck and large deep cavity, greenish-yellow in color, good in quality, in season in late October and early November.

Seckel—Seckel is the standard of quality in Amer-

ica and justly so. Found as a wildling near Philadelphia by a hunter over 100 years ago it was the first American pear to meet with European approval. The fruit though small, is perhaps the most desirable of all pears, and with its trim obovate shape, and bronze color it is a favorite wherever grown. The tree further recommends the variety for it is a blight resistant, shapely grower which bears annually and profitably where the ravages of pear thrip and pear psylla have not reduced the vigor of the tree and interfered with the set of fruit. It is in season in early October.

Sheldon—Sheldon is another high quality fruit, characterized by its apple-like shape, bronze color, and white rich juicy flesh. It matures at about the same season as Beurré Bosc, a fact which has had much to do with its apparent disregard. The tree, a vigorous grower, blights somewhat and is slow to bear. It has been meeting with renewed favor in commercial plantings.

Souvenir du Congrès—This variety merits attention only because odd trees are found in many orchards. The fruit is Bartlett-shape though slightly broader at the base, larger, and with a short stout stem set at an angle. The quality is only good; the season, September. The trees are hardy, vigorous, and productive, and do well on the quince.

Sudduth—Sudduth is another middle western variety prized for its heat and cold tolerant and blight

Fig. 9—Improving Pear Varieties by Breeding

FIG. 10—AN IMPROVED TYPE OF PRESSURE TESTER FOR DETERMINING FRUIT MATURITY

resistant trees. The fruit is only medium in size, roundish-oblate, light green, only a shade better than Kieffer, in season in late September and October.

Summer Doyenné—This is an old European variety much prized for the home orchard on account of its early highly flavored fruits. They are small, roundish, with long slender stem, waxen yellow, in season in early August. The trees are healthy, hardy, and productive.

Superfin—See Beurré Superfin.

Tyson—Tyson deserves more attention, principally because of its unusually healthy, hardy, prolific trees. The fruit, moreover, is juicy, aromatic, and very good in quality though only medium in size. The shape is acute pyriform with the flesh drawn up about the long, slender stem; the color, greenish-yellow; the season, a trifle before Clapp Favorite. Tyson can be strongly recommended for the home orchard.

Urbaniste—This pear is valued for home use because of its luscious fruits. They are medium in size, obovate-obtuse-pyriform, pale yellow, in season in late October and early November. The trees are vigorous and productive though somewhat subject to blight.

Vermont Beauty—Here is one of the most attractive of pears with its clear, glossy, brilliant red cheek, appearing almost identical with Forelle. The shape is obovate-acute-pyriform with the flesh folded about the long slender stem, and with conspicuous russet dots. The quality is very good and the season late October

and November. The trees are very hardy, vigorous, and productive though susceptible to blight.

Vicar of Winkfield—The large, long, yellowish gourd-shaped fruits of this variety with its short stout stem set at almost right angles to the fruit, require a long season and are not meeting with favor because of poor quality though much better when grown on the quince. The trees are large, hardy, and productive. The fruit is in season in December and January.

White Doyenné—This is the Virgalieu of western New York, one of the oldest and best-known pears, which is rapidly disappearing, like Flemish Beauty, because of its susceptibility to both scab and blight. The fruit is medium in size, obovate-obtuse-pyriform, clear pale yellow, very good in quality, in season in early October. The trees are hardy and productive. Where blight and scab can be controlled it is worth growing.

Wilder Early—Wilder Early might be likened to an early Bartlett in size, color, and shape, though more often highly colored. It matures early, before Clapp Favorite, and ships and keeps well for an early pear. The tree is large, vigorous, and a heavy cropper and has recently been planted rather heavily in sections of California.

Winter Bartlett—This is another variety considered promising for sections of California but disappointing under eastern conditions because of poor size and unattractive appearance. The fruit is large, ob-

long-obovate-pyriform, yellow splashed with russet, good in quality, in season in December and January. The trees are large, hardy, and productive.

Winter Nelis—Size and appearance are against this pear, yet it is perhaps the most esteemed winter variety and profitable where the market is familiar with it. The fruit is obtuse-obovate-pyriform, russeted, with long, curved stem, high in quality, in season from November to January. The tree is a poor grower in the nursery but becomes moderately vigorous in the orchard, characteristically straggling and crooked. It is hardy, and a good, regular bearer besides being esteemed as a pollenizer for other varieties.

Worden Seckel—Why Worden Seckel has not met with more favor is puzzling unless it be that it is not yet well enough known or because the trees are not quite as blight-resistant as Seckel and more fickle in regard to soil and climate. The fruits are the general shape of Seckel but have a dull red cheek over bright yellow and are not quite so high in quality. They are in season in late September and October, keeping a little later than Seckel.

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HANDLING THE FRUIT

THE PEAR, unlike the apple, is at once a delicate perishable fruit and a long-keeping storage commodity. Harvesting, ripening, and storage become of unusual importance, for unless the fruit is gathered at the right time, properly stored, and carefully ripened it is not at its best. In this chapter will be discussed the subjects of harvesting, ripening, storing, grading, packing, shipping, and marketing.

Harvesting—It has been said that unless the pear is gathered at the right time it is not at its best, a statement which is true for all varieties but especially for the early sorts, such as Elizabeth, Lawson, and Beurré Giffard, and for the late winter kinds, such as Easter Beurré, Passe Colmar, and Glou Morceau. If the former are gathered too late they are soft and mealy and quickly rot at the core. If the latter are harvested too early they shrivel, lack flavor, and exhibit all the earmarks of the immature fruit. Many excellent sorts have been bitterly condemned because they were picked either too early or too late. As a matter of fact the seasons are seldom long enough

north of New York City to properly mature most late winter varieties on standard roots.

There are many rules to guide in the picking of fruit, and there have been many intricate ones devised. The most useful of all is *color*. When a fruit loses its "grass green" color—even the slightest suggestion of a change—it is ready to be gathered. And while this rule may seem a little difficult to interpret, it is not. Most everyone knows the characteristic green color of a hard, immature apple, peach, or plum, and anyone who is watching the development of the fruit will notice the slightly different tinge as soon as it appears.

The adherence of the fruit to the stem is another fair test, which assumes that when the fruit is mature it will separate from the stem without difficulty. In the case of the Bartlett, for example, a slight upward lift of the fruit will bring it away from the stem nicely once it is mature. Color of seed is a less reliable index, brownish color being correlated with maturity and green or whitish color with immaturity.

In commercial sections of the West great importance has been placed upon the exact time of picking, more particularly with the Bartlett variety, which constitutes the bulk of the trade. Formulas have been devised which take into consideration factors of hardness, color, sugar content, and the like, which figured mathematically determine the condition of the crop. It is in these sections that the mechanical pressure tester

was devised, which is now extensively used and which is being adapted to other fruits. The method is based on the principle that it takes a certain definite pressure to make an indentation in the side of a fruit which is ready for harvest—greater pressure before reaching maturity and less pressure afterwards.

The apparatus now used has been refined so that it may be carried in the pocket. It consists of a metal rod about a foot long and half an inch in diameter upon which are graduated markings. A coil spring attached to a movable plunger at one end completes the necessary equipment. For convenience in reading and accuracy a small electric flashlight is mounted on the rod so that contact is made at the instant the plunger breaks the flesh, thus illuminating the scale and also admirably helping to determine the exact moment of break. In actual operation a thin slice of flesh and skin is removed in three or four spots on several pears, the fruits placed on a firm base, and a gradually increasing even pressure applied until the plunger breaks through the flesh, when the pounds exerted are read on the scale.

Where conditions are uniform, as they are in the concentrated irrigated fruit sections of the far West, the pressure tester works well, but under eastern conditions of uneven rainfall, diverse soil types, and scattered plantings the range between the same variety is large. Following a rain the reading is low. During dry spells it is high. These factors so complicate the

situation that as yet it has been impossible to lay down any definite rules. Hopefully, this will be done, for the importance of the proper time for harvest is recalled by the fact that fruit increases in size as long as it is on the tree and that in western orchards fruit has increased 20 per cent. in weight by permitting it to remain on the tree a few days longer than would otherwise have been done.

The fruit is separated from the stem by an upward movement, at the same time giving it a slight twist. Since pear trees are not overly large, ladders twenty feet and less will suffice. For small trees the three-legged stepladder is good. Picking bags with metal sides and canvas openings at the bottom, strapped to the picker by webbing shoulder straps are ideally suited for the pear harvest. The old style canvas picking bag was responsible for much bruised fruit from pressure against the ladder and branches of the tree. Eastern orchardists use half-bushel picking baskets very largely, though recently the 16-quart broad-mouthed milk pail has been found useful, any careless handling being easily heard. Picking bags are universal in the far West, yet it matters not so much what type basket is used so long as the fruit is carefully handled.

A similar statement applies to orchard containers. In the East barrels, bushel baskets, and orchard crates are used. In the far West the lug box is standard. Undoubtedly the box gives less bruising than the

slatted crate, the flexible bushel, or the heavy barrel, but any package is justified so long as the fruit is easily handled and without bruising. The tender skin and short stout stem common to so many varieties of pears makes careful handling imperative. Buerré d'Anjou, for example, should never be poured.

More than one picking can be made to advantage because the trees are small and accessible and because the market value of the product is relatively high. Three pickings are made in some pear sections, picking the large sizes the first time over, following with a second picking a week later of the fruit which has by that time gained in size, and finally stripping the tree of all that is left.

Grading—The vast majority of fruit is sized by hand. Pickers become very expert at picking by size, and sorters and packers complete the job with very little difficulty. Grading machines have not been so successful as with some other classes of fruit because of the peculiar shapes of different varieties and even of individuals within the variety. Where machines have been used to advantage the sizing has been done by weight rather than by diameter.

A sorting table has recently been devised on the Pacific Coast which consists of an upper and a lower circular chain of slowly moving canvas trays. Sorting is done by hand into the different trays as they pass and packing is done from the trays as they pass the packers. The device has proven very satisfactory

for even the delicate, more tender sorts which are liable to stem puncture from rolling or pouring on mechanical sizers.

There are many grades for pears. In eastern sections they are mostly optional but in western regions they are compulsory. Various shipping and coöperative organizations have theirs, individual States do likewise, and in addition the Federal Government has regulations which may be used for any part of the country.

The privately adopted grades of western coöperative associations are noticeably strict so that only the best product reaches the consuming market. Obviously it is not profitable to pay high transportation charges on the lower grades. The requirements for one association are:

"*Fancy:* This grade shall consist of absolutely perfect pears, shapely in form and free from all specks, blemishes, scale, worms or bruises of any kind.

"*Choice:* This grade may contain fruit slightly scarred or limb marked, but must be free from worms."

In order to dispose of as much fruit as possible two additional classes have been made, but needless to say the number of boxes of both are very few. They are:

"*Off Grade:* Overripe and slightly wormy fruit which might be used locally or by those demanding a cheap article.

"*Unwraps:* Fruit under 2 inches in diameter, which may be used for pickling purposes."

Packing—The barrel, the bushel-basket, and the climax basket are universal containers for eastern sections, while the box is standard for the western sections. Tender varieties such as Clapp Favorite, Beurré Bosc, Bartlett, and Beurré d'Anjou are packed in bushels; such kinds as Kieffer and Lawrence frequently move in barrels; while Seckel is commonly sold in smaller baskets though it is also packed in bushels and barrels. The straight-sided bushel is especially well suited to the pear trade and has been meeting with rapidly increasing favor.

The dimensions of the pear box are 18 inches long by 11½ inches wide by 8½ inches deep, slightly smaller than the standard apple box. The minimum weight is 45 pounds and in practice is more often 50 pounds. Each fruit is neatly wrapped in paper and placed firmly in the box, so that it is well nested and cannot move in the pack. A tight, solid pack is absolutely necessary, for without it the fruit will shuck about during its long voyage to market and be severely bruised. The tendency has been to have an excessive bulge of 2½ to 3 inches on the top of the box and only slightly less on the bottom, the idea being that slight bruising produced by putting on the cover of so tight a pack is less severe than bruising in transit in a loose pack. More recently the bulge has been decreased to about an inch on both top and bottom, a special effort being made to compensate for

less bulge by building the pack more snugly and firmly as the pears are nested in the box.

The following suggestions as to the style of pack to be used for different size fruit will be found helpful.

Four Tier—Pears must be 2¾ inches in diameter or larger.

Size—Inches	Pack wide long	Number in Layer	Number in Box
3¼ to 3⅜	3-2 by 4-4	20	80
3⅛ to 3¼	3-2 by 4-5	23-22	90
3 to 3⅛	3-2 by 5-5	25	100
2⅞ to 3	3-2 by 5-6	28-27	110
2¾ to 2⅞	3-2 by 6-6	30	120

Five Tier—Pears must be 2¼ to 2¾ inches in diameter. The maximum number of pears in a 5-tier pack is 180. Packs 3-3 wide and 6-7 or 7-7 long, which give 195 and 210 pears to the box respectively are placed in the six-tier class and are so considered.

Size—Inches	Pack wide long	Number in Layer	Number in Box
2⅝ to 2¾	3-3 by 4-5	27	135
2½ to 2⅝	3-3 by 5-5	30	150
2⅜ to 2½	3-3 by 5-6	33	165
2¼ to 2⅜	3-3 by 6-6	36	180

Six Tier—Pears must be 2 to 2¼ inches in diameter and only a small percentage can be 2-inch or the box will be underweight.

Size—Inches	Pack wide long	Number in Layer	Number in Box
2 by 2¼	3-3 by 6-6	36	216
2 by 2¼	3-3 by 6-7	5 tier—39	195
2 by 2¼	3-3 by 7-7	5 tier—42	210

Storing and Ripening—This is one of the most important problems in pear production and has had much to do with the relative commercial value of pear varieties. The Bartlett, for example, may be picked two or three weeks before it is really fit and yet it will ripen nicely in storage. On the other hand Passe Colmar, Duchess d'Angoulême, and other winter sorts sometimes shrivel and rot before reaching an edible condition. Once a fruit has shrivelled it will not ripen properly. A week or two before pears are to be used they should be brought into a warmer temperature so that they may ripen. Storing and ripening are two different processes.

The chief point to remember in storing pears is that they lose moisture more quickly than apples and must consequently be better protected from air currents and evaporation. For home use resort has been made quite successfully to the center of a barrel of apples, while packing in hay and straw is also good. Storing in bins or open containers usually ends in failure unless the total mass of fruit is so large as to prevent drying.

The best temperature to hold pears has not been definitely determined but is usually considered slightly higher than for apples—32 to 34 degrees Fahrenheit.

This can be maintained in commercial cold storage plants but can only be approached in the common storage. At this temperature the ripening processes go on very slowly and the fruit stays firm and sound. At higher temperatures they go on very rapidly. It is for this reason that fruit should be put into storage as promptly after gathering as possible. Twenty-four hours of high temperature seriously affects keeping quality.

High relative humidity and good ventilation are necessary. Pears are notoriously quick to acquire foreign flavors and odors so that the storage should be clean and all decayed fruit regularly removed. The bank cellar, air-cooled storage, and cool cellar may all be used successfully, though practical experiment with any particular one is the only sure way to determine its real worth. The ideal is a constant temperature, high humidity, good ventilation, and freedom from foreign odors.

The advantages of storage are many. From the commercial standpoint varieties may be held until the bulk of the crop is passed, usually with profit. Clapp Favorite in eastern sections is regularly stored until the rush of western fruit has passed, while Kieffer is likewise held for winter markets. Because of the relatively high value of the product, pears deserve special attention towards uniform distribution.

Marketing—As with all other commodities, success with pears depends upon finding out what the

market wants and then supplying it. The demands of the local market are quite separate from those of distant or export market. Local markets require quality, variety, and succession. Distant markets require uniformity, reliability, and good appearance; while the export market demands certain varieties, usually winter sorts that will carry well, packed to meet particular needs. Kieffer has been the great favorite for export but recent shipments of Bartlett and Winter Nelis and other winter sorts have shown the possibilities in this trade.

Sales in eastern sections are usually through commission houses or to local buyers. In the West, coöperative methods have resulted in increased local representative selling, F. O. B. sales with inspection at shipping and receiving points, and auction selling. Auctions in large consuming points have been especially successful and have developed to such a degree that sales are made even on cars in transit. Such practice is, of course, dependent upon standardized, reliable packs.

Shipping—For local market the truck is well suited. For distant shipments water and rail are used, in connection with which refrigeration is essential. Even for export markets most shippers prefer the certainty of fast refrigeration movement to the dangers of cheaper hit-and-miss methods. If pears can be precooled before shipment so that they reach a low temperature promptly they will repay the effort. The

pear, as has been said, is a perishable product and a long-keeping commodity. Without attention to every detail it will quickly become over-ripe so as to be unfit for storage, or it will break down or become otherwise unfit for consumption.

Canning and Drying—The canning of pears, like the canning of most fruits, is an industry which has grown rapidly and which has proven a boon to many sections far from market. The prices paid to growers have been steady and fair so that in some localities the fruit is grown solely for canning purposes while in other places the early crop is packed and the late crop canned, experience having shown that low prices may be expected on the late fresh fruit market. The benefit has been alike to the grower who ships fresh fruit to distant market and to the grower who sells to the canning trade because a better distribution of fruit is realized. The drying industry, likewise, has become of major importance in some regions; for example, Lake County in California, which is remote from railroad shipping points.

For canning, the fruit should be 2½ inches in diameter or larger. It is picked in lug boxes, and delivered direct to the canning factory, the boxes being returned to the original owner at the end of the season. For drying, the fruit is gathered before it is ripe and allowed to ripen in bins for eight or ten days. When it is fully ripe it is halved, the stem and calyx removed, and placed cut side up on trays 8 feet long

and 3 feet wide to be dried in the open. Like other dried fruit products dried pears are bleached in sulphur fumes so as to whiten them and make them more attractive, while at the same time storage insects are repelled and decay organisms destroyed. Sulphuring is done in especially constructed houses or under movable hoods.

XI

FUTURE DEVELOPMENT

Improvement of Varieties—The future of the pear industry is dependent upon the variety question as much as upon any other single factor. At the present moment the words "pear" and "Bartlett" are almost synonymous so superior has this one variety been for commercial pear culture in America. Yet because of its limited season and because of the sameness that it gives to consumers it is a limiting factor in pear production. Healthy development of the pear industry is dependent upon the creation of new varieties which are adapted to commercial growing.

There is no reason why the pear should not be as highly esteemed and as extensively grown in America as in Europe. Most of the varieties known today originated in the climate of Europe and are little suited to American conditions. It is conceivable that more attention to the development of pear varieties especially suited to America would be met with reward.

The season needs to be extended. Winter sorts, long-keeping varieties, as well as summer kinds of high quality are necessary. In addition there is need

for hardier, more blight resistant trees so that pear growing may be extended into the colder regions of the North and into the warmer regions of the South. Here is a challenge for the pear breeder that deserves immediate attention, for while progress may be made as it has in the past through chance findings of seedlings, more rapid progress may be expected through a systematic attempt to recombine characters of known worth in new varieties. Further testing of recent chance acquisitions should be encouraged, as well as renewed testing of some old varieties discarded in times past because they did not meet with the conditions that the times demanded. The pear industry has changed sufficiently in the past quarter century to make it appear probable that some of these old sorts may now be of value.

Since the Bartlett type of pear is so universally known it would seem that new varieties having Bartlett earmarks would be most quickly accepted by the consumer and by the grower. And it is likely that in this direction the pear breeder will work, trying to develop the Bartlett-type fruits of both earlier and later season. Most rapid progress will be obtained by using varieties of merit as parents, though long-time projects involving the crossing of new species may in the end prove more valuable by virtue of the incorporation of new characters. Bartlett is a good parent, stamping its offspring with good size, appearance, and quality. Seckel, strangely enough, does not give a high propor-

tion of worthwhile seedlings, many running too small in size to be of value. Tyson, because of its vigorous, healthy tree and good quality fruit, promises well, and Josephine de Malines, Pitmaston, Winter Bartlett, and Louise Bonne de Jersey have proven of value in producing size and late keeping. Yet so little is known about the performance of pear varieties as parents that one sort is as likely to prove the right one as any other.

Breeding—For those who may care to breed new varieties the methods in use may be very briefly sketched. The two essential parts of the flower are the male part or stamens which produce the yellow pollen-powder familiar to all, and the female part or pistil which when fertilized by the pollen produces seed having characters of both parents. The breeder must control the transfer of pollen. Before the blossoms are open, which means before the pollen is mature enough to fertilize the flower, he carefully cuts away the stamens just inside, leaving the pistil in the center of the flower. Then by means of a paper bag tightly fastened about the twig by a string or a copper-wired garden label he protects his work from the contamination of insect visitors, and in about three days the pistil shows a tiny droplet of sticky fluid at its tip and is ready to receive the pollen that is to fertilize the blossom and produce seed.

During the three days that the pistil occupies in developing to this stage, the breeder visits the closed

flowers of the tree he wants for the male parent in his cross and removes some of the stamens which he places in a warmer place to ripen. The bags are now removed from the bagged flowers, the finger pressed into the dish of pollen, and the tips of the pistils gently touched so as to deposit some of the myriads of tiny pollen grains upon them. In very careful work the finger is sterilized both before and after applying the pollen by dipping into alcohol. The bags are replaced and left for a few days until the seed has formed, netting bags then being used in their stead as protection from birds and from loss through dropping.

The seed is removed, stored over winter in a cool moist situation such as wrapped in a piece of wire screening and buried in a foot of soil outdoors. It is planted in early spring and from it develops the seedling tree combining the characters of both parents to a greater or lesser degree as the case may be. Breeding is an interesting and valuable occupation and merits the attention of more individuals.

Commercial Trend—There is no mistaking the rapid increase in pear growing in America, especially on the Pacific Coast. Commercial fruit enterprises have been largely occupied in the past with apple production and in recent years with no very large profit. On the other hand pears have proven profitable wherever they have been successfully grown so that the situation has arrived where missing apple trees are being replaced by pear trees and a noticeable swing

is evident towards pears in preference to apples. In the Yakima Valley in Washington, in the Hood River Valley in Oregon, and to a lesser extent in the Wenatchee Valley in Washington, which are all known primarily for their apples, the pear is on the increase. In the Rogue River Valley in southern Oregon pear acreage is gaining while in California the growth has been very large.

Since the plantings have been mostly of the Bartlett variety pear growers have already evidenced fear of the final outcome. As a result there is an increase in the planting of varieties which are on the market at different seasons, especially winter sorts. Beurré d'Anjou is first in importance, followed by Beurré Bosc, Winter Nelis, and Flemish Beauty. In addition coöperative organizations have begun advertising campaigns to acquaint the consumer with the virtues of the pear and its wide range of flavor and appeal.

Happily the pear offers several convenient outlets. In the first place Europe is well acquainted with this fruit and prefers it to many others. American pears have been favorably received there, though the lack of winter varieties, which export trade particularly demands, has limited movement. There is a bright future for winter sorts for export trade as well as for home consumption. At the same time the canning and drying industries are in a healthy and growing condition, which puts them in a position to utilize excess pro-

duction. Since the Bartlett variety is admirably adapted to both of these trades it is hoped that any overproduction that may result from its overplanting will be taken care of through these channels.

Still another hopeful sign is the effort on the part of pear growers to improve the *quality* of their product. Accurate tests of maturity, such as the pressure test already described, mean higher quality and a better satisfied consumer. Likewise storage and ripening studies result in similar improvement. Much can be done and needs to be done along both of these lines.

On the other hand, the home orchard is gradually disappearing, giving way to the superior product of a specialized commercial industry. Blight, psylla, thrip, and unfavorable weather conditions have completely wiped out small, poorly cared for plantings. This condition is most evident in eastern and southern sections and means an increased opportunity for commercial culture. At the same time there is an apparent new interest in new and unusual fruits, a situation to which the pear is admirably adapted. All in all, the indications are for renewed interest in the pear in America.

INDEX

A

Acid phosphate, use as a fertilizer, 51
Adaptation of the pear, 19, 23
Adaptation—climate, 23
——soil, 23, 24
Amateur interest in dwarf pears, 58
America, pear development in, 16
Ammonium sulfate, use as a fertilizer, 51
Angers Quince, 60
Anjou, variety described, 81
Ansault, variety described, 80.
Apple, grafting on the, 57
Arsenate of lead, 78
Ashes, wood, 51
Aspidiotus perniciosus, 74

B

Bacillus amylovorus, 66
Bacteria in the soil, 48
Barley, 49
Barry, Patrick, 18
Bartlett, variety described, 80
——mentioned, 18, 25, 29, 53, 54, 64, 67, 69, 70, 79, 80, 106, 108, 110
——pruning and blight, 37
Bearing habit of the pear, 33
Bearing tree, the pruning of, 40
Bees, effect upon fruit setting, 52, 54
Belgium, pear development in, 14
Belle Lucrative, variety described, 80
——mentioned, 64
Bending, 37
Bessemianka, variety described, 81
Beurré d'Anjou, fruit setting of, 56
——planting distance for, 28
——variety described, 81
——variety mentioned, 53, 54, 63, 69, 70, 79, 80, 106, 117
Beurré d'Arenberg, variety described, 81
——mentioned, 64
Beurré Bosc, on the quince, 58
——variety described, 82
——variety mentioned, 54, 64, 71, 80, 106, 117
Beurré Clairgeau, variety described, 82
——variety mentioned, 54, 63, 69, 71, 79
Beurré Diel, on the quince, 58
——variety described, 82
——variety mentioned, 63
Beurré Giffard, variety described, 82
——mentioned, 80, 100
Beurré Hardy, variety described, 83
——mentioned, 60, 63
Beurré Superfin, variety described, 83
——mentioned, 63, 80
Bivort, 15, 16
Blackheart, 26
Blight, 66, 68
——relation to pruning, 37
Blister mite, 76
Bloodgood, variety described, 83
——mentioned 63, 80
Bosc, variety described, 82
Boston, in pear history, 18
Boussock, variety described, 85
Bouvier, 15
Box, dimensions of, 106
Branches, bending of, 37
Breeding, 114, 115
Buckwheat, 49
Buckwheat and millet, 49
Budding, 43

Buffum, variety described, 84
——mentioned, 64, 80

C

Calcium caseinate, 77
California, pear industry in, 20, 23
Canning, 111
Carpocapsa pomonella, 75
Central-leader tree, 29
Chinese pear, 13, 18
Chinese sand pear, 13
Clairgeau, variety described, 82
Clapp Favorite, variety described, 84
——mentioned, 25, 29, 53, 54, 67, 79, 80, 106, 109
——pruning and blight, 37
Cleft-graft, use of the, 43
Climate, part played in adaptation, 23
Close-centered tree, the, 30
Codling moth, 75
Colmar, variety mentioned, 64
Colorado, pear industry in, 22
Columbia, variety mentioned, 64
Comice, variety described, 86
Commercial trend, 116
Conference, variety described, 84
Contarinia pyrivora, 76
Corrosive sublimate, use in blight control, 68
Cover crops, in general, 47
——rate of seedage, 49
——time of sowing, 49
Coxe, William, 17
Cultivation, in general, 45, 46
——in the young orchard, 31

D

Daimyo, variety mentioned, 13
Dana Hovey, variety described, 84
——mentioned, 54, 80
Dearborn, variety described, 85
De Jonghe, 15
Delaware, in pear history, 17
——pear industry in, 22
De Nelis, 15
Development of the pear, 11
——future, 113
Diseases in general, 65
——blight, 66
——leaf blight, 71
——leaf-spot, 70
——red leaf, 71
——scab, 69
Distance of planting, 28
Distances, planting for the dwarf tree, 61
Dix, variety described, 85
——mentioned, 64
Dorset, variety described, 85
Double-working, 63
——Beurré Hardy used in, 60
Douglas, variety described, 85
Downing, A. J., 18
Downing, Charles, 18
Doyenné Boussock, variety described, 85
——mentioned 64, 80
Doyenné du Comice, variety described, 85
——mentioned, 54, 79
Dried blood, use as a fertilizer, 51
Drouard, variety described, 94
Drying, 111
Dry-mix, 77
Duchesse d'Angoulême, variety described, 86
——mentioned 63, 69, 71, 80, 108
——on the quince, 58
Duhamel du Monceau, variety described, 86
Dunmore, variety mentioned, 64
Dusting, 77
Dust materials, 77
Dwarf pears, 57
——culture of, 60
——life of, 59
——planting distances for, 61
——pruning of, 61

E

Early Harvest, variety described, 86
East, pear industry in, 20
Easter Beurré, as a pollenizer, 54
——described, 87
——mentioned, 54, 63, 100
Elizabeth, variety described, 87
——mentioned, 64, 80, 100
England, pear development in, 16
Eriocampoides limacina, 76
Eriophyes pyri, 76
Espéren, 15, 16

European pears, top-working, 44
Export trade, 110, 117

F

Fabraea maculata, 71
Failure of dwarf trees, 58
Fertilizers, at planting, 28
——in general, 50
——time of application, 51
Fire-blight, 66
Flemish Beauty, variety described, 87
——mentioned, 28, 64, 69, 70, 71, 79, 80, 117
Flowers, pear, 34
——essential parts of, 52
Forelle, variety described, 88
——mentioned, 64
Franciscan Friars, in pear history, 17
French Huguenots, in pear history, 16
French missionaries, in pear history, 16
Fruit, canning, 111
——grading, 104
——handling, 100
——harvesting, 100
——how borne, 34
——marketing, 109
——packing, 106
——picking, 103
——ripening, 108
——setting of, 52
——shipping, 110
——storing, 108
Future development, 113

G

Garber, variety described, 88
——mentioned, 18, 54, 80
Giffard, variety described, 88
Glou Morceau, variety described, 88
——mentioned, 58, 63, 100
Gold Dust, variety mentioned, 13
Gorham, variety described, 88
Grand Valley, pear industry in, 22
Grades of fruit, 105
Grading, 104
Grafting on apple, 57
——on hawthorn, 57
——on quince, 57
Gray Doyenné, 64
Grégoire, 15, 16
Growing conditions, East vs. West, 40
Growth, nature of in East, 40
——nature of in West, 40

H

Hardenpont, Nicholas, 15
Hardy, variety described, 83
Hawthorn, grafting on the, 57
Heading, at planting, 29
——the dwarf tree, 62
Heading-back, 34, 35, 37
——at planting, 29
Height of head, 29
——for the dwarf tree, 62
Hood River Valley, pear industry in, 22, 117
Howell, variety described, 89
——mentioned, 54, 64, 67, 79
——pruning and blight, 37
Hudson River Valley, in pear history, 16, 18
——pear industry in, 23
Hybrid pears, 13, 25
Hydrated lime, 77
Huguenots, in pear history, 16

I

Idaho, variety described, 89
——mentioned, 80
Illinois, in pear history, 16
——pear industry in, 22
Indiana, in pear history, 16
Inhibiting substance, theory of in bending, 38
Insects, in general, 72
——blister mite, 76
——codling moth, 75
——pear midge, 76
——pear psylla, 72
——pear slug, 76
——pear thrip, 75
——San Jose scale, 74
Inter-sterility in the pear, 53

J

Japanese pear, 13
Jargonelle, variety described, 89
——mentioned, 63
Josephine de Malines, variety described, 89
——mentioned, 63, 115

K

Kainite, use as a fertilizer, 51
Kenrick, William, 17
Kieffer, variety described, 90
——in pear history, 17
——mentioned, 53, 54, 69, 71, 80, 106, 109, 110
——origin of, 18
——planting distances for, 28
——pruning the young, 36
——spreading of the, 39
——stubbing of the, 40, 41
——top-working of the, 44
Kingsessing, variety described, 90
——mentioned, 64
Koonce, variety described, 90

L

Lamy, variety mentioned, 63
Lawrence, variety described, 91
——mentioned, 53, 54, 64, 69, 71, 80, 106
Lawson, variety described, 91
——mentioned, 100
Leaf blight, 71
Leaf-spot, 70
Le Conte, variety described, 91
——mentioned, 54, 69, 80
——origin of, 18
Leguminous cover crops, 48
Lime-sulfur, 77
Lincoln, variety described, 91
Lincoln Coreless, variety described, 92
Little pruning, 33, 37
Location of the orchard, 25
Long pruning, 41
Long Island, in pear history, 16
Louise Bonne de Jersey, variety described, 92
——mentioned, 58, 63, 115
Lucrative, variety described, 80

M

Madeleine, variety described, 92
——mentioned, 63
Manning, Robert, 17
Manning, Robert, Jr., 18
Marie Louise, variety described, 92
——mentioned, 64
Marketing, 109
Maturity, tests for, 101
Michigan, in pear history, 16
——pear industry in, 22
Midge, 76
Millet, 49
Miscible oil, 77
Missouri, pear industry in, 22
Mite, 76
Mount Vernon, variety described, 93
Mulch, sod, 47
Mycosphaerella sentina, 70

N

New England, in pear history, 17
——pear industry in, 21
New Jersey, in pear history, 17
——pear industry in, 21
New York, in pear history, 17
——pear industry in, 20, 21, 23
Nicotine sulfate, 77
Nitrate of soda, 51
Nitrogen, relation to blight, 56
——use as a fertilizer, 50, 51
Non-leguminous cover crops, 48
Northern Spy, spreading of, 39
Nova Scotia, in pear history, 16
Nursery stock, selection of, 26
——for the dwarf tree, 62
——special forms, 42
Nutrition, 55

O

Oats, use as a cover crop, 49
Occidental pears, 12
Oil sprays, 77
Old tree, pruning of the, 41
Old World species, 12
Onondaga, variety described, 93
——mentioned, 64
Orchard, care of the young, 30
——location, 25
——starting the, 25
Oregon, pear industry in, 22
Organic matter in the soil, 48
Origin of the pear, 12
Osband, variety mentioned, 63
Osband Summer, variety described, 93
Oriental pears, 12, 18
——top-working, 44

P

Pacific Coast, in pear industry, 17

Pack, style of, 107
Paint, for pruning wounds, 36
Passe Colmar, variety described, 93
——mentioned, 100, 108
P. Barry, variety described, 93
Pear, bearing habit of the, 23
——development of the, 11
——origin of the, 12
——propagation of the, 26, 27
——sand, 13
——sage, 12
——snow, 12
——species of, 12
——where grown, 19
Pear industry, comparison of East and West, 20
——in the East, 21
——in the West, 22
Pear midge, 76
Pear psylla, 72
Pear scab, 69
Pear slug, 76
Pear stocks, 26, 27
Pear thrip, 75
Pear wood, nature of, 34
Pears, hybrid varieties, 13, 25
——occidental, 12
——oriental, 12
Pennsylvania, in pear history, 17
Peter Stuyvesant, 16
Phelps, variety described, 94
Philadelphia, in pear history, 16, 17
Phosphate, raw rock, 51
Phosphoric acid, as a fertilizer, 50, 51
Picking, 103
Pineapple, variety described, 94
Pistil, 52
Pitmaston, variety described, 94
——mentioned, 115
Planting, distances, 28
——distances for the dwarf tree, 61
——pollenizers, 55
——time of, 27
Pliny, 15
Plowing, in general, 45
——time of, 45, 46
Polarity, 38
Pollenizers, planting distances for, 55
——varieties suitable as, 54
Pollination, 52
Potash, amount used, 50, 51
Potassium chloride, 51
Potassium sulphate, 51
Pound, variety described, 94
Président Drouard, variety described, 94
Pressure tester, 101
Propagation, 26, 27
——budding, 42, 43
——double-working, 60
——grafting, 43
——top-working, 42
Provo District, pear industry in, 23
Pruning, at planting, 28
——cycle in, 32
——effect upon fruit setting, 56
——heading-back, 34, 35
——in general, 32
——little, 33
——long, 41
——nature of, 33
——protection of wounds, 36
——relation to blight, 37
——renewing the old tree, 41
——stubbing, 40
——thinning-back, 34, 35
——thinning-out, 35
——types of cuts, 34, 35
Pruning the bearing tree, 40
Pruning the dwarf tree, 61, 62
Pruning the Kieffer, 36
Pruning the old tree, 41
Pruning the young tree, 36
Psylla, 72
Psylla puricola, 72
Pulteney, variety described, 95
Pyrus calleryana, 14
——as a stock, 27
Pyrus communis, description of, 12
Pyrus nivalis, description of, 12
Pyrus serotina culta, description of, 13
Pyrus ussuriensis, 14
——as a stock, 27

Q

Quakers, in pear history, 16
Quince, for dwarfing, 57
——grafting on the, 57
——root, resistance to aphis, 60
——types of, 60

R

Rain, effect upon fruit setting, 52
Raw rock phosphate, use as fertilizer, 51
Red leaf, 71
Renewing the old tree, 41
Ripening, time of, 100
Rochester, in pear history, 18
Rock phosphate, raw, 51
Rogue River Valley, pear industry in, 22, 117
Rostiezer, variety described, 95
——mentioned, 64
Roosevelt, variety described, 95
Root aphis, resistance of quince to, 60
Roots, trimming at planting, 28
Rutter, variety described, 95
Rye, as a cover crop, 49
Rye and vetch, as a cover crop, 49

S

Sage pear, 12
St. Lawrence River, in pear history, 16
Salem, Massachusetts, 17
Sand pear, 13, 18
San Jose scale, 74
Scab, 69
Scaffold branches, selection of, 29
Seckel, as a pollenizer, 54
——described, 95
——fruit setting, 56
——in pear history, 17
——mentioned, 25, 53, 54, 64, 67, 69, 71, 79, 80, 106
Sections, for the pear, 19
——eastern, 21
——western, 22
Seedage, rates for cover crops, 49
Selection of scaffold branches, 29
Self-sterility in the pear, 53
Setting of fruit, 52
Sha Lea, variety mentioned, 13
Sheldon, variety described, 96
——mentioned, 58, 64, 69, 71, 80
Site for the orchard, 26
Slug, 76
Snow pear, 12
Sod, relation to blight control, 68
Sod mulch, in general, 47
——in the young orchard, 31
Sodium nitrate, 51
Soil, for the dwarf pear, 61
——for the pear, 25
——for the quince, 61
——part played in adaptation, 23, 24
Souvenir du Congrès, 96
Soybeans, 48, 49
Species, Old World, 12
——*Pyrus calleryana*, 14
——*Pyrus communis*, 12
——*Pyrus nivalis*, 12
——*Pyrus serotina culta*, 13
——*Pyrus ussuriensis*, 14
——Sand pear, 13
Species of pears, 12
Spray materials, 77
Spray schedule, 77
Spraying, 77
Spreading, in general, 37, 39
——the Kieffer tree, 39, 40
——the Northern Spy apple, 39
Stamen, 52
Starting the orchard, 25
Sterility in the pear, 53
Stock, nursery, 26
——selection for the dwarf tree, 62
Stocks, adaptability of varieties to, 63
——for the dwarf pear, 57
——pear, 26, 27
Storing, 108
Stubbing, 40, 41
Sudduth, variety described, 96
——mentioned, 80
Sulfate of ammonia, 51
Sulfur, 77
Summer Bon Chrétien, in pear history, 16
Summer Doyenné, variety described, 97
——mentioned, 69
Superfin, variety described, 83

T

Taeniothrips pyri, 75
Tankage, use as fertilizer, 51
Theophrastus, 15
Thinning-back, 34, 35
Thinning-out, 35, 37
Thrip, 75

Tillage, 46
Time of planting, 27
Top-working, 42
——relation between varieties, 44
Training the young tree, 29
Training to particular forms, 41
Trees, number in New York and California, 20
Trend, commercial, 116
Tying down of branches, 37
Types of training, 29
Tyson, variety described, 97
——mentioned, 64, 67, 80, 115

U

Urbaniste, variety described, 97
——mentioned, 64
Utah, pear industry in, 22

V

Van Mons, Jean Baptiste, 11, 15, 16
Varieties, blight resistant, 80
——commercial, 79
——described, 80
——for the home orchard, 79
——hardy, 80
——inter-sterile, 54
——not suitable for dwarfing, 64
——requiring double working, 64
——self-sterile, 53
——succession of, 80
——suitable for dwarfing, 63
Vase-shaped tree, 29, 30
V-shaped tree, 29, 30
Venturia Pyrina, 69
Vermont Beauty, variety described, 97
Vetch, as a cover crop, 48
Vicar of Winkfield, variety described, 98

W

Washington, pear industry in, 22
Washington, variety mentioned, 64
Weather, effect upon fruit setting, 52
West, pear industry in the, 20
Whip-grafting, 43
White Doyenné, described, 98
——mentioned, 64, 80
Wilder Early, described, 98
——mentioned, 71
Wilder, Marshall P., 11
William's Bon Chretien, identity of, 18
Winter Bartlett, described, 98
——mentioned, 115
Winter Nelis, as a pollenizer, 54
——described, 99
——mentioned, 53, 54, 64, 70, 79, 80, 110, 115
Wood ashes, use as fertilizer, 51
Wood, nature of pear, 34
Worden Seckel, described, 99
Wounds, protection of, 36

Y

Yakima Valley, pear industry in, 22, 117
Young orchard, care the first season, 30
Young tree, pruning the, 36

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A Statement of Principles with Special Reference to Their Present Use in America

By FRANK A. WAUGH

Professor of Landscape Gardening at the Massachusetts Agricultural College

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